

How do we respond to stimuli?

Objectives

We are going to learn about:

- the organisation and functions of the human body.
- the different parts of the nervous system.
- the responses of the nervous system.
- how sensory organs function.
- the sense of touch.
- the different parts of the musculoskeletal system.

03 Useful language

- I think my impulse to move comes from (my brain).
- An animal that cannot perceive and react to its surroundings, will probably (die very soon).

02 A genius with a special brain

Wolfgang Amadeus Mozart probably had one of the greatest brains in history. At the age of 5, he gave his first piano concert and played pieces that professional musicians found difficult.

However, he suffered from a disorder of the nervous system: Tourette syndrome. This disorder's symptoms include a feeling of restlessness, multiple tics, and obsessive behaviours that make relationships with other people difficult.

Despite this, Mozart was able to write some of the world's most beautiful music, which seems to have beneficial effects on its listeners.

Some psychologists claim there is a Mozart effect, in which the composer's music has positive effects on the development of intelligence and the creativity of babies and children. Many other psychologists, however, say there is no such effect.

One thing that is certain is that music acts on the nervous system, causing it to produce chemical substances that can give listeners a sense of wellbeing.

*Revista colombiana de psiquiatría. 2019
(translated and adapted)*

1. What neurological disorder did Mozart suffer from?
2. Some psychologists believe listening to Mozart can help babies and children. What do they say the benefits are?

Think

- Do you like listening to music?
- Where do you think your impulse to move comes from?

Do you know?

- How do we understand and remember what is happening around us?
- Why do we run to escape from danger?

Reflect

- Imagine that there is an animal that cannot perceive and react to what is happening around it. What do you think will happen to it?

The human body and its life processes

Like all living things, humans consist of cells that are grouped together to form more complex structures, which enable them to perform the life processes.

Levels of organisation in the human body

In rising order of complexity, the structures of the human body are:

- **tissues.** These are similar cells that come together to perform a function. In the human species there are many specialised tissues, such as muscle or nerve tissue.
- **organs.** They consist of different tissues that work together. For example, the heart is an organ that is made up of several types of tissue: muscle tissue, which contracts; a type of epithelial tissue that covers the outside; and nerve tissue, which accelerates or slows the heartbeat.
- **systems.** These are sets of organs and other structures that perform a certain function. For example, the digestive system is responsible for the digestion of food.

- a What tissues does the heart consist of? What is the function of each?

The coordination of the human body

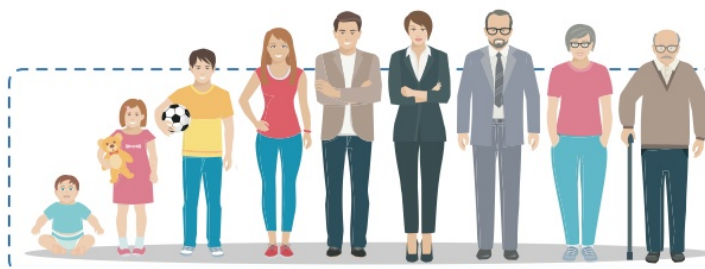
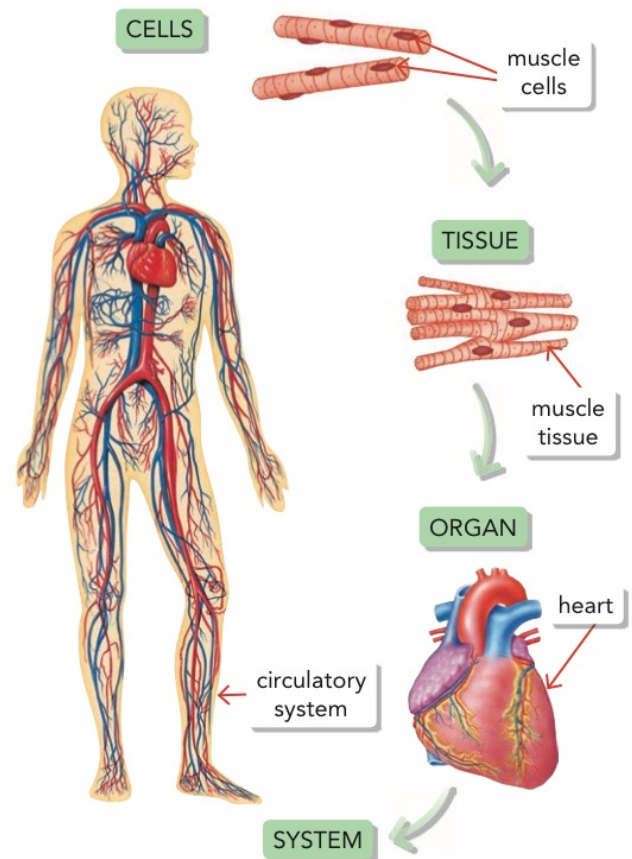
The human body is able to function because all of its systems cooperate to perform complementary life processes. The systems responsible for the coordination of the human body are the **nervous system** and the **endocrine system**, which controls the release of **hormones**.

- b Which systems are responsible for the coordination of the human body?

Find and define:

- tissue
- organ
- system
- hormone

The levels of organisation in the human body



What are hormones?

Hormones are chemical substances that regulate many processes, such as growth, the amount of sugar in the blood, or the appearance of secondary sexual characteristics.

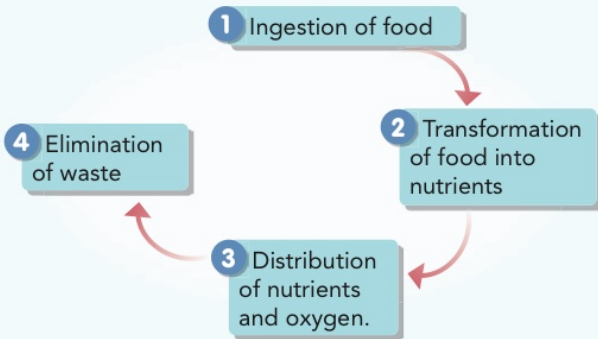
► Learn more: The life processes of the human body

Because of its structure, organisation and complexity, the human body is capable of performing the life processes that characterise all living things:

Nutrition

This consists of ingesting **food** and breaking it into small particles so that it can reach all the cells. The **digestive, circulatory, respiratory** and **excretory** systems all participate in the life process of nutrition.

Stages of nutrition



Interaction

This consists of perceiving internal and external signals with the help of the **nervous system**, and responding to them through the **musculoskeletal system**, among others.



Reproduction

This is the creation of new individuals with characteristics similar to the parents. The **female and male reproductive systems** participate in this process.



► Understand, apply and reason

- 05 Copy and complete the sentences. Then, listen and check:

 - The human body consists of ..., which are grouped together to form tissues.
 - Human tissues are grouped together to form ..., and these perform a specific ... process.
 - The three life processes are: ..., interaction and
- Copy the following sentences in your notebook and write which life process or system they relate to:

 - This perfume smells like roses.
 - Emma has a new baby brother.
 - Pick up the ball!
 - Do not run after eating.

The parts of the nervous system

The **nervous system** consists of the organs and other structures that control and coordinate all the actions involved in the process of interaction.

This system perceives **external stimuli**, such as hearing music or recognising danger, as well as **internal stimuli**, such as hunger or thirst. The nervous system's reactions to these stimuli are called **responses**.

The nervous system is divided into the central nervous system, and the nerves.

- The **central nervous system** consists of four organs, also called nerve centres, that are connected to each other: the **cerebrum**, **cerebellum**, **brainstem** and **spinal cord**.
- The **nerves** are distributed throughout the body and are responsible for transmitting the stimulus and responding to it.

- a What four organs make up the central nervous system?



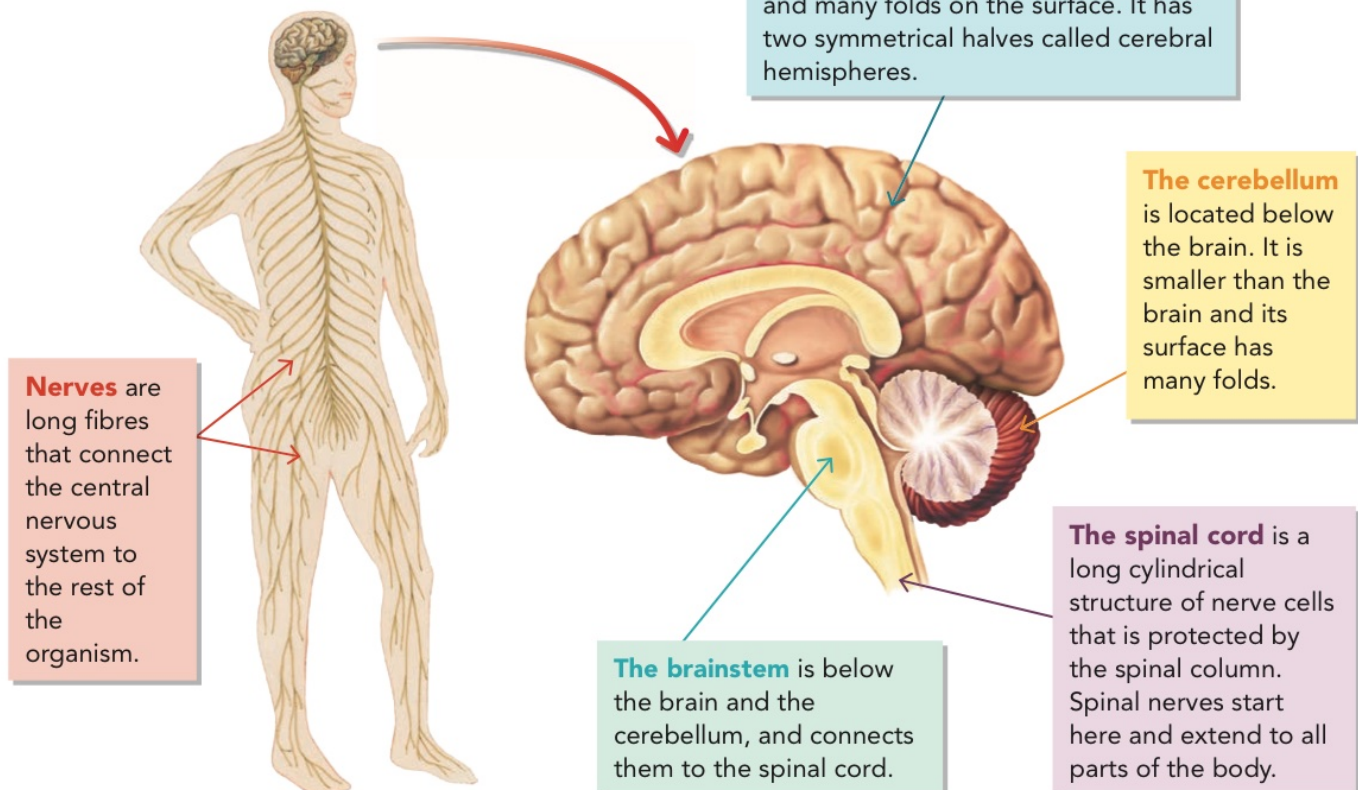
Central nervous system

Find and define:

- | | |
|--------------------------|---------------|
| • nervous system | • brainstem |
| • central nervous system | • nerves |
| • brain | • spinal cord |
| • cerebellum | • neuron |



Parts of the central nervous system



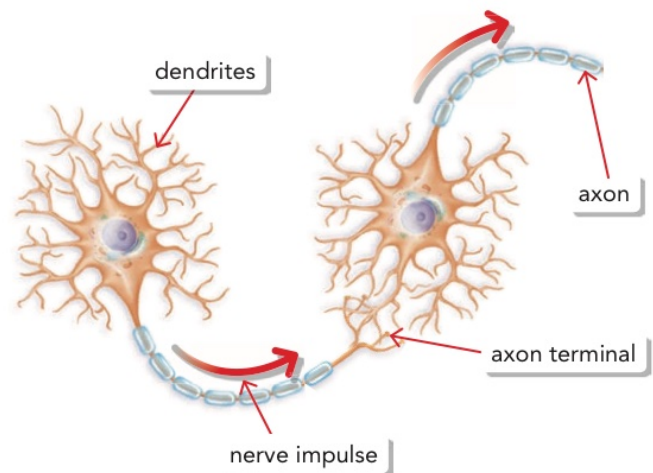
What are neurons?

The nervous system consists of specialised cells called **neurons**. These cells have many short fibres called **dendrites** and one long fibre at the end called the **axon**.

The axon of a neuron connects with the dendrites of the neuron next to it. The nerve impulse passes into the neuron through the dendrites and leaves through the axon terminal. Thousands of axons group together in this way to form a nerve.

A signal, like a very weak electrical current, passes through them. This is called a **nerve impulse**.

The connections between neurons



b What does a neuron consist of?

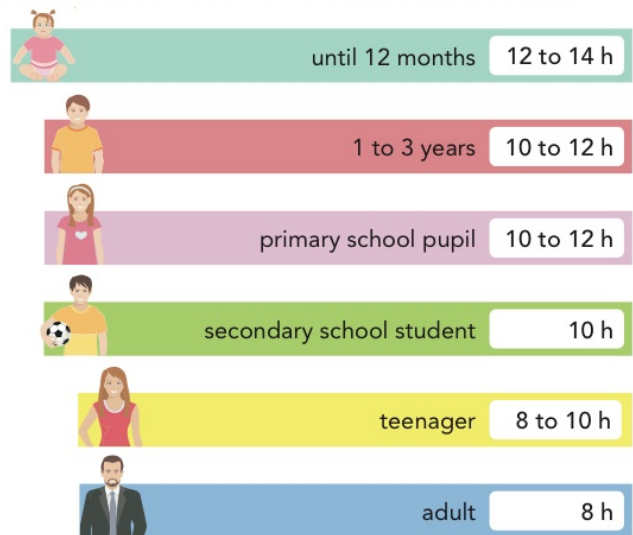
The importance of sleep

Our nervous system cannot remain active all the time, it also needs to rest. When we **sleep**, our nervous system is inactive and is able to rest.

The amount of sleep a person needs depends on several factors, such as age and lifestyle.

- Babies need to sleep every three hours and adults need a total of eight hours a day.
- A 10-year-old child needs about 10 hours sleep every night.

A child who does not get enough sleep will not only feel tired. Lack of sleep can also cause problems associated with behaviour, growth, performance at school, IQ levels and obesity.



Understand, apply and reason

3. Find out more about the nervous system at www.tiching.com/774344. Then, answer:

- What are the three components of a neuron?
- What is the gap between two neurons called?

4. **07** Correct the false sentences in your notebook. Then, listen and check:

- The nervous system's reactions to stimuli are called answers.

b) The nervous system consists of the organs and other structures involved in the process of nutrition.

c) The central nervous system consists of four organs: the cerebrum, heart, brainstem and spinal column.

d) Nerve impulses enter the neuron through the spinal cord and leave through the brainstem.

the responses of the nervous system

The central nervous system responds to stimuli through **voluntary** and **involuntary** actions.

What are involuntary actions?

Involuntary actions are those we do not choose to do. A **reflex action** occurs when we move our hand away after touching something hot, or when our mouths water after seeing food that we like.

Other involuntary actions are produced in our bodies spontaneously and are responses to internal stimuli that we are not **aware of**. For example, the movements associated with digestion or breathing, or the contraction of the heart.

- a What are some of the involuntary actions that our central nervous system **performs**?

Involuntary reactions to a stimulus

Reflex actions are useful when we need to react quickly in unexpected situations.

For example, when we touch something that is very hot, our muscles contract and our arm bends to protect us.

- b Why are reflex actions useful?

- a The **sensory nerves in the skin** perceive the heat and send a nerve impulse to the spinal cord.
- b The spinal cord carries the signal directly to a **motor nerve**, which is connected to the muscle.
- c The motor nerve orders the **muscle** to contract and the arm bends.

— nerve that receives the sensation
— spinal cord nerve
— nerve that transmits the response

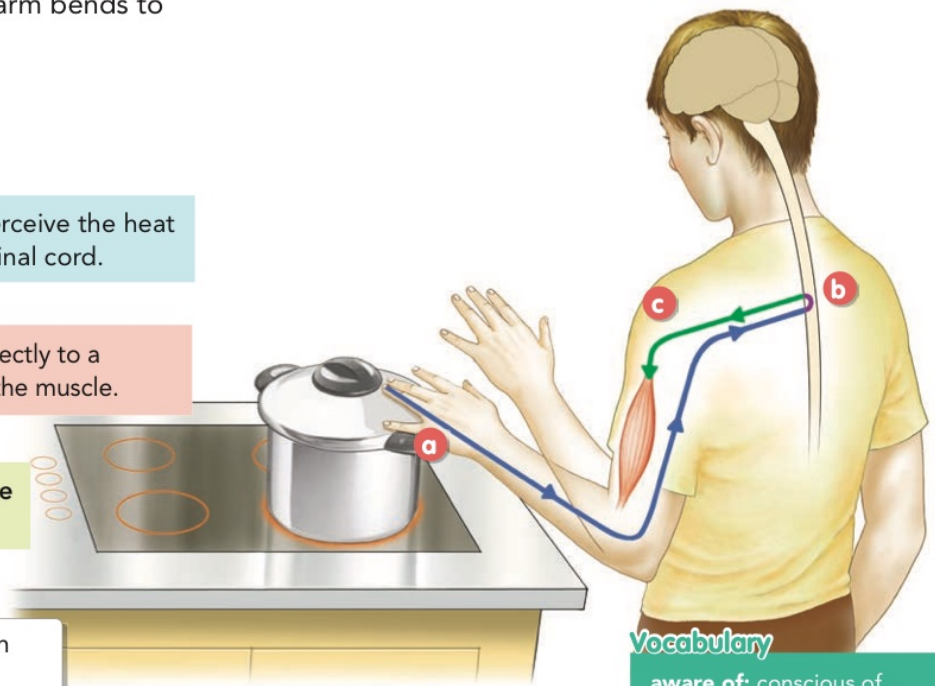
Find and define:

- voluntary action
- reflex action
- involuntary action



A sneeze is a reflex action to a stimulus that affects a membrane inside the nose called the nasal mucosa.

Involuntary reflex action



Vocabulary

aware of: conscious of
performs: produces; does

Voluntary actions

Voluntary actions are those that we choose to do. When we run, read or sit down, we are performing voluntary actions.

We have to learn voluntary actions and many of them can then be done without thinking, such as riding a bicycle or walking.

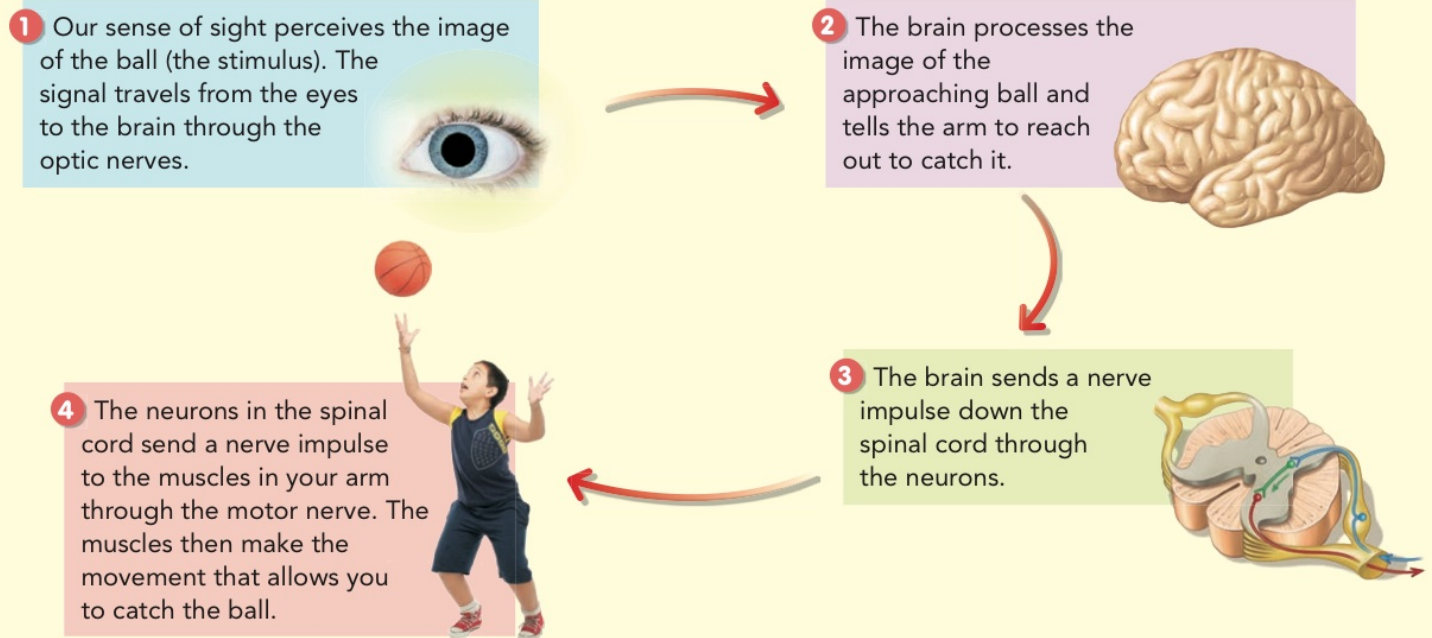
These actions are considered to be more complicated than involuntary actions because the processes involve more neurons.



The act of moving your arms and legs in a coordinated way to swim is a voluntary action.

- c Why are voluntary actions more complicated than involuntary ones?

Voluntary actions



Understand and explain

5. **LS1** How do you think your body would react in these situations?
- You see a delicious fruit salad.
 - You hear a loud bang.
 - You take a bite of a very hot slice of pizza.
6. Think of an example of each of the two types of nervous actions (make sure they are not the

examples in the text). Then, draw and label them in your notebook. Compare your examples with a classmate and explain them.

7. In pairs, make a list of voluntary and involuntary actions. Then, take it in turns to act them out for another group to guess. They need to name the action and say whether it is voluntary or involuntary, e.g. Standing up is a voluntary action.

sensory organs

Sensory organs are receptors that capture external stimuli. They consist of cells that send these stimuli to the central nervous system, which interprets and responds to the information received.

The main senses are: **sight, hearing, smell, taste** and **touch**.

Touch

Our sense of touch allows us to perceive sensations through our skin, which is an organ that covers and protects our body.

Touch **receptors** specialise in detecting stimuli, such as pressure, temperature (cold or heat) and pain.

These receptors can detect light pressure, such as clothes on skin, or intense pressure, such as the vibration of a mobile phone.

a What stimuli does our skin respond to?

Taste

Our sense of taste is located in our **tongue**. The **taste receptors** in our tongues detect the flavours of food. These receptors are grouped together and form **taste buds**, which are tiny elevations of different shapes on the surface of the tongue.

We now know that we detect different flavours on all parts of the tongue.

b Do different areas of the tongue detect different flavours?

What flavours are there?

The basic flavours are: **bitter**, like coffee; **sour**, like lemon; **sweet**, like sugar; and **salty**, like salt. All other flavours are a mixture of these.

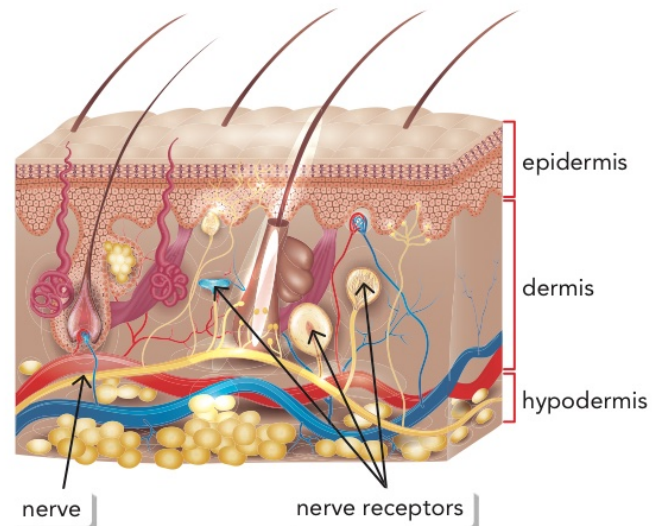
A new flavour, called **umami**, was discovered in 2001 by an American scientist.

Umami in Japanese means tasty. This flavour is found in foods like serrano ham, mature cheese and asparagus.

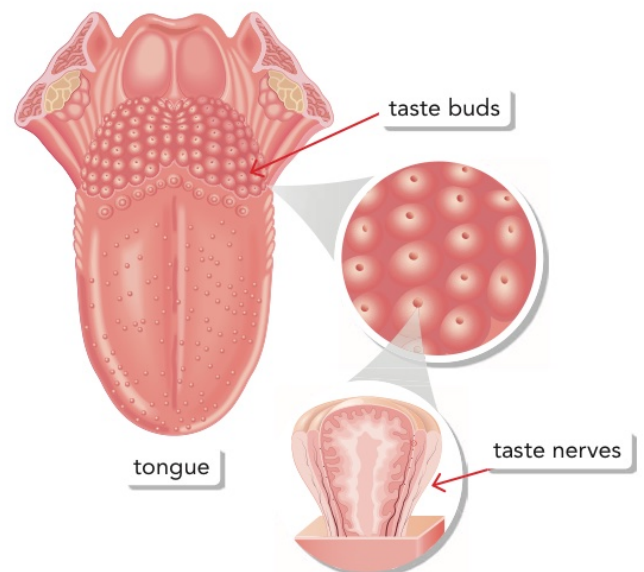
Find and define:

- sensory organs
- receptors
- taste buds
- olfactory epithelium

Parts of the skin



Taste receptors



Smell

Our sense of smell is located in our **nose**.

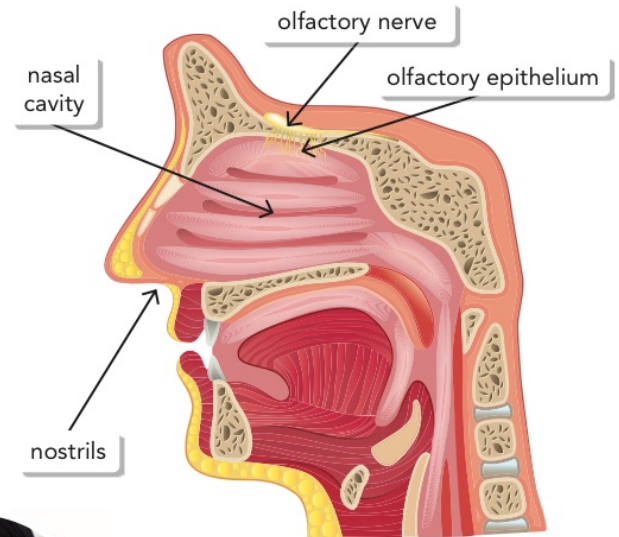
In the upper part of the nasal cavity, there is a membrane called the **olfactory epithelium**. This is where the **olfactory receptors** that perceive odours are located.

There are hundreds of different types of olfactory receptors, each of which detects a few specific substances. This is why we can detect such varied and complex odours.

Olfactory receptors are easily saturated, so we quickly become used to an intense smell and stop perceiving it.

- C** Why can we detect such a large variety of smells?

Parts of the nose



The senses of taste and smell work together

When we eat, we taste and smell at the same time, so we can enjoy the flavours more.

An example of this relationship between the senses of taste and smell is that when we have a cold, our airways are obstructed and we cannot smell food well. For this reason, we cannot taste flavours well.



Perfumes and some fruits have an intense smell.



► Understand and explain

8. **LS2** In groups, collect some objects and put them in a big bag. Swap your bag with another group. Then, take it in turns to close your eyes and feel the objects.

What do the touch receptors in your fingertips tell you about the shape, texture and temperature of the objects?

Can you guess what the objects are?

– Which objects were the most difficult to identify? Which were the easiest? Can you explain why?

9. Divide these words into smell or taste. Which relate to the location of the sensory receptors? Which relate to stimuli?

– flavour – smell
– olfactory epithelium – taste buds

10. Complete these sentences in your notebook:

a) The ... contains the olfactory receptors.
b) The skin is the ... of touch.
c) The sensory organ responsible for smell is the
d) Taste receptors are found in ... on the tongue.

11. Think about what food you ate last week. Choose three salty foods, three sweet foods, three sour foods, three bitter foods and three umami foods. Which list is more difficult to complete? Why?

10 identify the most sensitive areas of the skin

To identify the most and least sensitive areas of the skin, we need to measure the sensitivity of various areas using materials with different textures.

Find out more about the science of your skin:

www.tiching.com/774347



Understanding the sense of touch

1 How do we perceive objects through touch?

When we touch a surface or object, the **epidermis**, or outermost layer of the skin, becomes deformed.

The receptors located in the **dermis** send a nerve signal to inform the brain of the pressure. This allows us to know that we are touching something.

The deepest layer of the skin, the **hypodermis**, does not have any nerve endings, so it does not participate in the sense of touch. Its function is to insulate us from cold and heat, and to absorb impact.



a What is the role of the hypodermis?

What is Braille?

Braille is a tactile reading and writing system for blind people.

It was invented by the Frenchman Luis Braille, who was blind from the age of three. He worked as a teacher at an institute for the blind in Paris and created his own system of reading and writing

through groups of points.

Although touch is the least sensitive of the senses, it can be improved with practice.

Blind people who use Braille acquire great sensitivity in their fingertips, allowing them to read only through touch.

b Who uses Braille to read? How do they do it?



12. Match the following words to their definitions:

outermost - layer - blind - fingertips

a) unable to see

b) exterior

c) ends of the fingers

d) a level or stratum

2 How can we find out how sensitive our skin is on different parts of the body?

Work in pairs for this stage of the experiment:

1. Cover your partner's eyes with a scarf. Open the points of a paperclip by 0.5 cm. Use a ruler to help you.
2. On the parts of the body listed in the table below, place the two points of the paperclip on your partner's skin. Ask them if they feel one point or two and write their answer in the table.
3. Repeat the process, but this time opening the points of the clip to 2 cm.
4. Next, place the **sandpaper** on the same parts of your partner's body and record in the table whether they feel a **rough** or smooth surface.

Now, study your skin's sensitivity to temperature. Work on your own for this stage of the experiment.

1. Put one hand in hot water and, at the same time, put the other hand in cold water. Leave them for a few minutes.
2. Dry your hands and put both hands in a container of lukewarm water.

Vocabulary

lukewarm: at room temperature

sandpaper: paper with sand used to make wood smooth

rough: the texture of sandpaper; abrasive

Material

- a long scarf
- a hairpin or paperclip
- a piece of sandpaper
- a container of cold water from the fridge
- a container of hot water
- a container of **lukewarm** water
- a ruler

Part of the body	Points at 0.5 cm	Points at 2 cm	Sandpaper
forearm (inside)	...	...	...
forearm (top)	...	...	...
forehead	...	...	...
lips	...	...	...
palm of the hand	...	...	...
fingertips	...	...	...

Apply what you know

13. After you complete the table, answer these questions:

- a) When the points of the clip were close together, on which parts of the body did your partner feel two separate points?
- b) What part of the body seems to be the most sensitive? Which parts are the least sensitive?

- c) When your hands are in the containers of water, what do you feel? How does each hand notice the temperature of the water? What conclusion do you reach after conducting this experiment?

14. Design a small experiment to find out which parts of the body are most sensitive to heat or cold, using the ideas and techniques you learnt today.



the eye and the sense of sight

The eye

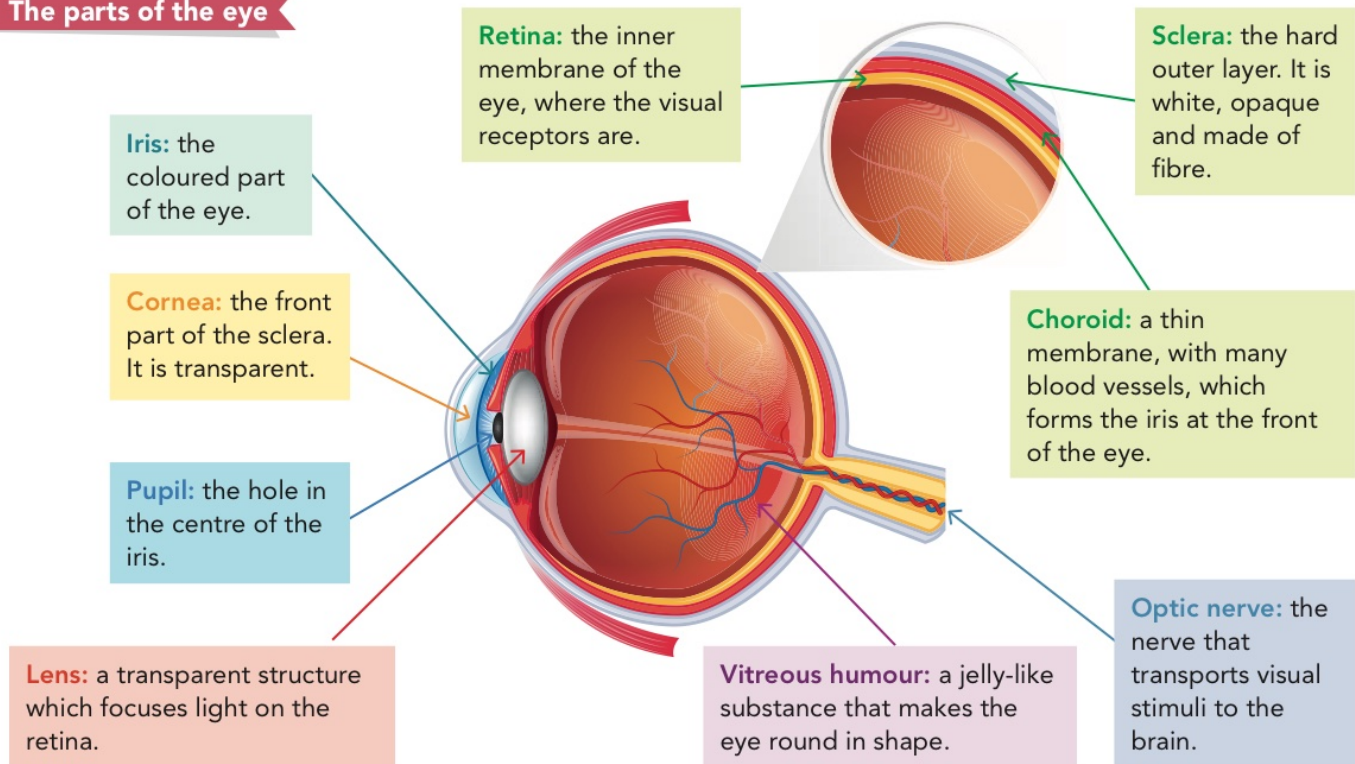
The **eyes** are the sensory organs for sight. The eye is made up of three layers: the **sclera**, the **choroid** and the **retina**. Other parts of the eye are: the **cornea**, **lens**, **pupil**, **iris**, **vitreous humour** and **optic nerve**.

What are the three layers of the eye?

Find and define:

- iris
- cornea
- pupil
- vitreous humour
- retina
- sclera
- choroid
- optic nerve

The parts of the eye

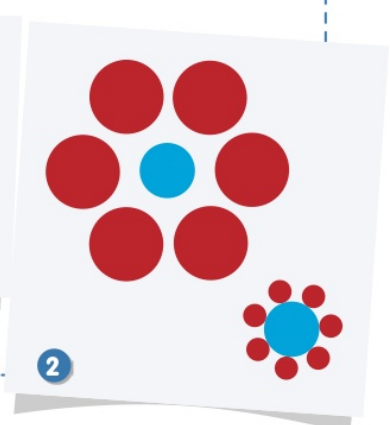
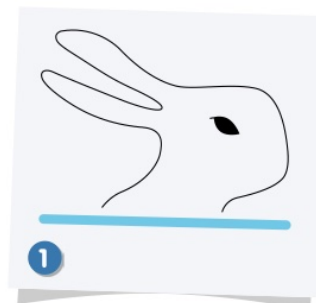


What do you see?

The **optic nerve** sends the images detected by the retina to the brain. But each person's brain can interpret them in different ways.

Test yourself: what can you see in image 1, a duck or a rabbit?

Optical illusions occur when the brain wrongly interprets the visual information it receives. When you first look at them, do you think the two blue circles 2 have the same diameter? Check your answer.



Sight

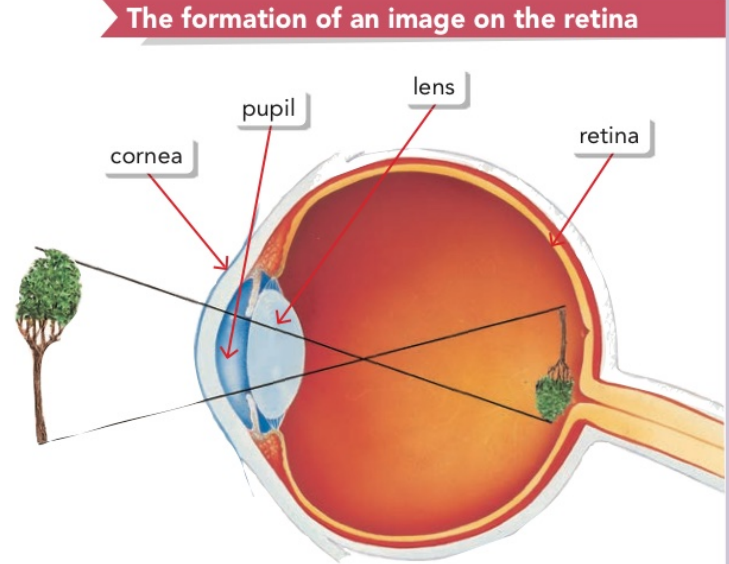
Sight consists of the perception of images through our eyes.

To be able to see an image, such as a tree in a landscape, light has to enter the eye through the **cornea**. It then crosses the **pupil** and the **lens**, and it reaches the **retina**, the part of the eye that is sensitive to light.

An image forms on the retina and transforms into a nerve signal. This signal reaches the brain for interpretation through the optic nerve.

The image projected on the retina is upside-down and much smaller than the real image.

b Where does light enter the eye?



Vision disorders

Most people have some sort of vision disorder. The most common are myopia, hyperopia, astigmatism and presbyopia (from 40 or 50 years of age).

- **Myopia** occurs when a person can clearly see a nearby object but has trouble seeing distant objects. This happens when the image forms in front of the retina instead of on it
- **Hyperopia** occurs when a person can clearly see distant objects but has trouble seeing nearby objects. Some people may not notice it, especially when they are young. When hyperopia is serious, people may have blurred vision.
- **Astigmatism** is a disorder in which the eye does not focus objects on a single point of the retina, but on more than one. This produces a blurred or elongated image.
- **Presbyopia**, or eyestrain, is a defect related to age. As the eye ages, the lens stops being able to change shape, which prevents people seeing nearby objects clearly.

Understand and explain

- 15.** Complete the sentences in your notebook. Then, listen and check:
- The eye is made up of three layers: the ..., the choroid and the
 - The ... nerve transports visual stimuli to the brain.
 - The ... is the coloured part of the eye.
 - The part of the eye that is sensitive to light is the
 - The most common vision disorders are

myopia, ..., ... and presbyopia.

- Draw a diagram with words and arrows showing the path that light takes, after it enters the eye through the cornea until it reaches the brain.
- Why do you think the cornea needs to be transparent?
- An adult blinks (shuts and opens the eyes quickly), on average, 10 times every minute. How many times will an adult blink every day if they sleep for eight hours?

the ear and the senses of hearing and balance

The ear

Our ears are divided into three parts:

- The **outer ear**. This consists of the **pinna** and the **external ear canal**.
- The **middle ear**. This is a small cavity that conducts sound. It starts with the **eardrum** and contains a chain of three tiny bones: the **hammer**, **anvil** and **stirrup**.

This cavity conducts sound to the **inner ear** through the **oval window**.

- The **inner ear**. This contains the **cochlea**, which converts sound into nerve impulses.

What are the three parts of the ear?

Find and define:

- | | |
|-----------|---------------|
| • hammer | • cochlea |
| • anvil | • eardrum |
| • stirrup | • oval window |

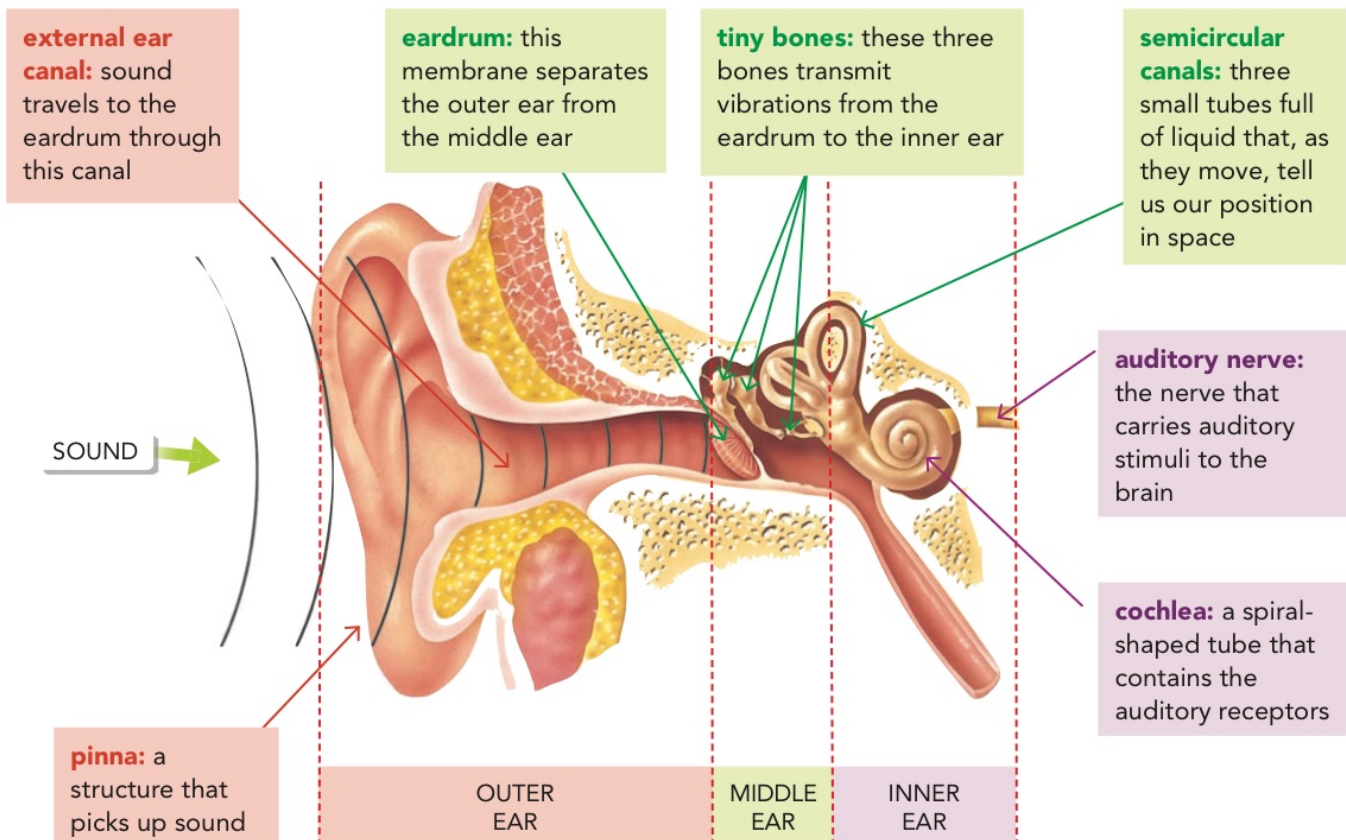
What is the sense of balance?

Our sense of balance is linked to the inner ear. People with good balance are aware of the position of their bodies and movements.

Any rapid changes in our balance can cause dizziness and vertigo. This is when we feel like the world is spinning.



The parts of the ear



Hearing

Hearing occurs when our ears detect and process sound. Sound travels in the form of **sound waves** that pass through the air. These waves enter the ear, travel along the external ear canal and arrive at the eardrum.

When the eardrum receives these waves, it vibrates and passes the vibrations to the tiny bones in the inner ear. These bones then pass the vibrations to the oval window.

As the oval window oscillates, the liquid in the cochlea moves. This then makes the **auditory receptors** move, sending the signals to the brain through the auditory nerve.

- b** How does sound travel through the air?



Web detectives

19. To learn more about hearing, go to: www.tiching.com/774403
- How does listening to very loud music affect hearing loss?
 - How does a doctor test for hearing loss?
 - How does deafness affect a person's ability to relate to other people?
 - What is sign language?



Hearing disorders and ear disease

Agnosia, or the inability to recognise or differentiate sounds, is not an ear problem but the inability of the brain to interpret the sounds.

Partial or total lack of hearing, **deafness**, may be hereditary or caused by other factors. These include maternal rubella during pregnancy, childbirth complications, infectious diseases (e.g. meningitis), certain medications, exposure to loud noise or ageing.

Deafness and hearing disorders can be prevented by following medical advice, such as not listening to loud music and not spending too much time in noisy places.

Hearing loss related to old age (**presbycusis**) is very common.

Understand and explain

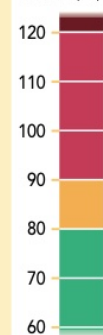
20. Draw and label a diagram with the three main parts of the ear and their structures. Then, add arrows showing the path of sound from when it enters the ear until it reaches the brain.
21. Listen to these sounds and answer the questions: What are they? Can you put them in order from loudest to quietest?
22. The maximum sound intensity permitted by the World Health Organisation is 65 decibels. Look at the information on the right and say which activities are harmful to the ear and what are the time limits for avoiding injury.

TIME LIMIT FOR EXPOSURE (WITHOUT PROTECTION) BEFORE CAUSING DAMAGE



- From 120 to 140 dB: a few seconds are enough to cause irreversible damage
- 107 dB: 1 minute a day
- 101 dB: 4 minutes a day
- 95 dB: 15 minutes a day
- 92 dB: 30 minutes a day
- 86 dB: 2 hours a day
- 80 dB: 8 hours a day

sound intensity in decibels (dB)



EUROPEAN LEGISLATION



105 dB
Legal limit for nightclubs and bars that play music



100 dB
Legal limit for personal devices (MP3)



80-85 dB
Legal limit in the workplace



sounds that cause irreversible damage
 danger: harmful sounds
 potentially harmful
 no risk

The musculoskeletal system

We often respond to external stimuli with movement. For example, when we are in a dangerous situation, we respond by running away.

The **musculoskeletal system** allows us to move. It has two elements: the **skeletal system**, which consists of **bones** and **joints**, and the **muscular system**, which consists of **muscles** and **tendons**.

- a What does the musculoskeletal system consist of?

The skeletal system

The **skeletal system** consists of bones and joints.

The **skeleton** is like armour that supports the body and gives it shape. It protects our internal organs, such as the brain, heart and lungs.

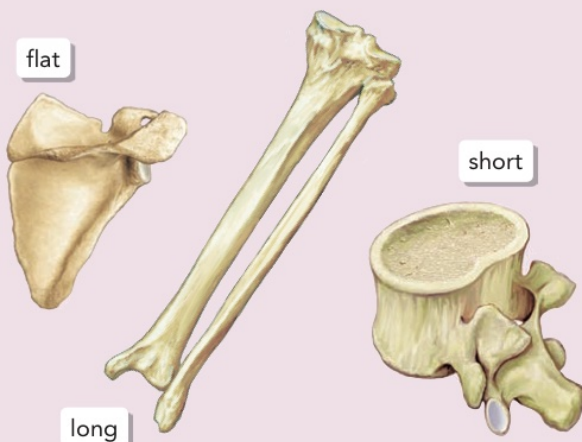
The human skeleton is made up of about 206 **bones**.

- b Approximately how many bones are there in a human skeleton?

Types of bones

Depending on their shape, there are three types of bones:

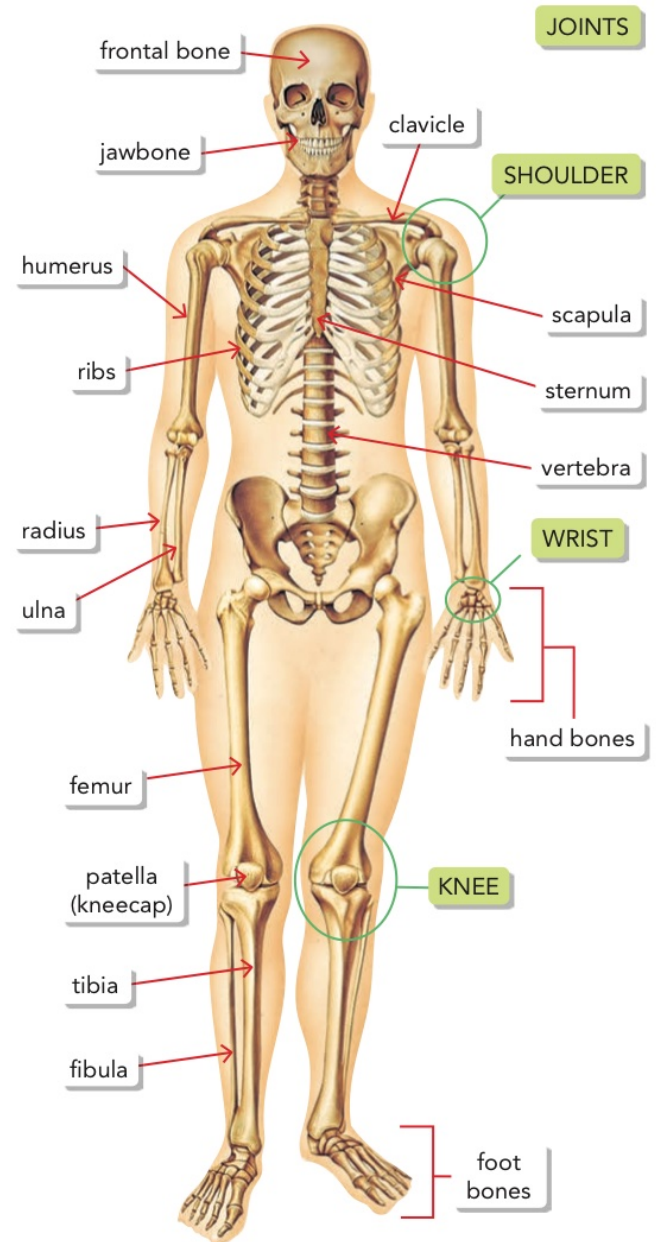
- **Long**, like the tibia and fibula.
- **Short**, like the vertebrae.
- **Flat**, like the skull and scapula.



Find and define:

- musculoskeletal system
- bones
- skeleton
- joints

Bones and joints in the human body



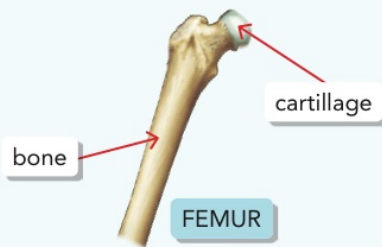
► Learn more: What are the bones and joints of the human body?

In addition to bones, the human skeleton consists of other structures that allow the bones to move.

What tissues are bones made of?

Bones consist of two types of tissue:

- **Bone tissue**, or osseous tissue, is compact and hard.
- **Cartilage** is softer and forms the ear and nose, and the ends of long bones.



Joints

These connect our bones. They can be:

- **flexible**, like the knee, which allows movement.
- **semi-flexible**, like vertebrae, which allow small movements.
- **fixed**, like the skull, which does not move.



Can the number of bones vary?

Very young children have more bones than adults. Generally, these bones fuse together as the child grows.

Some bones, like those in the skull, can merge into one.



The bones in a baby's skull are not fused together, which makes it easier for the baby to come out of the birth canal.

► Understand, apply and reason

23. What bones are there in the spine? In what part of the body are they? What joints connect them?

24. 16 Which numbers are correct? Listen and check. How many bones are there:

- a) in a human body (100/200/over 200)?
- b) in a hand (20/27/37?)
- c) in a foot (6/26/27?)

25. Say which bones and joints you use to do the following actions:

- a) Lift your arm while it is straight.
- b) Hold in your stomach.
- c) Move your head from side to side.
- d) Stand on your toes.
- e) Stand up from sitting

The muscular system

The **muscular system** consists of muscles and tendons.

Muscles are the **structures** that allow us to move the skeleton. They are attached to the bones by **tendons**.

When a muscle contracts, it becomes shorter and thicker and the tendons pull the bones and produce movement.

a What happens when a muscle contracts?

Muscles

Muscles consist of muscle tissue cells that can increase and decrease in size when stimulated by impulses from the nervous system.

There are three types of muscle tissue: **striated**, which contracts voluntarily; **smooth**, which contracts involuntarily, and **cardiac**, which forms the heart.

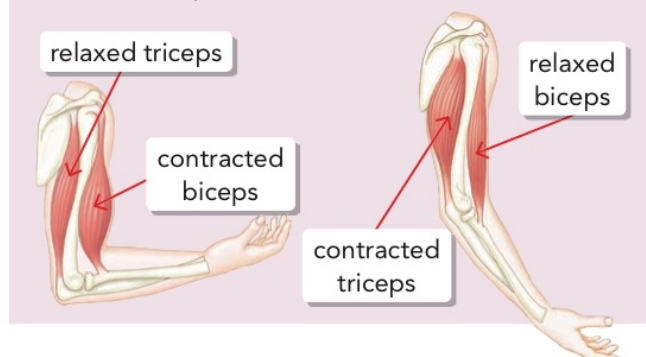
b What are the three types of muscle tissue?

How do muscles contract and relax?

Muscle contraction is usually coordinated, so that when one muscle contracts, another relaxes.

For example, to lift your forearm it is necessary for the biceps to contract. At the same time, the triceps relaxes and allows the elbow to bend.

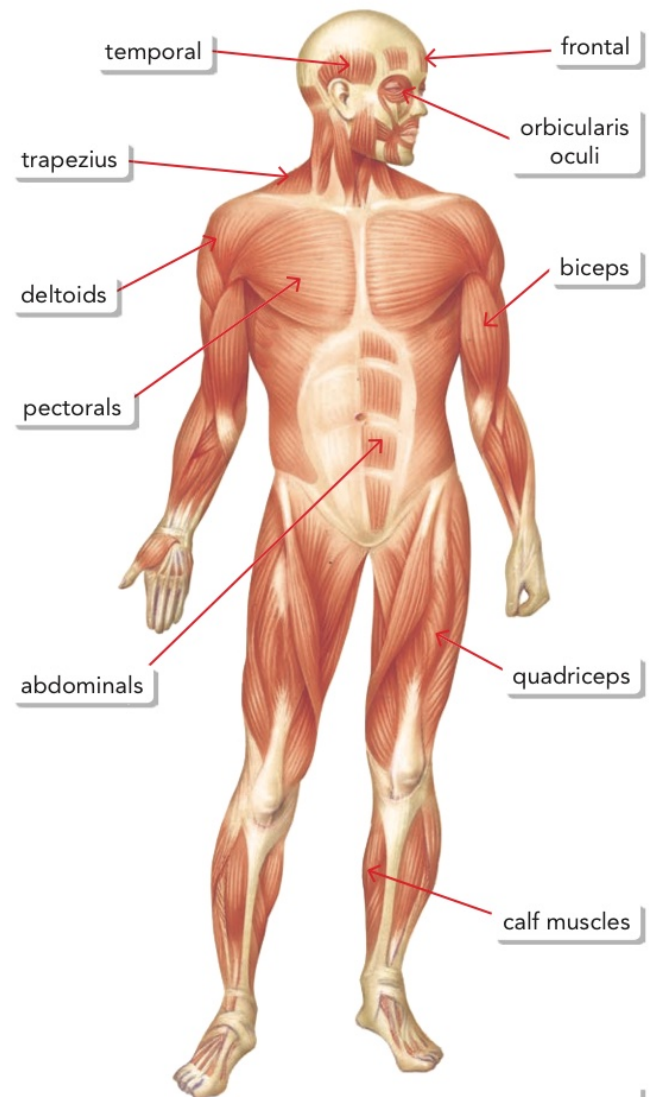
But when we extend an arm, the biceps relaxes and the triceps contracts.



Find and define:

- muscle
- tendon
- ligament
- tendinitis

Muscles of the human body



The human body has about 650 striated muscles that constitute about half the weight of a person.

► Learn more: Tendons and ligaments

Tendons

Tendons are very strong cords that are located at each end of the muscle. They consist of tissue and fibres that cannot contract, but that are incredibly strong and rigid.

Tendons join muscles to bones so when muscles contract, the bones they are connected to move.

❶ Where are tendons located?

calf muscles

Achilles tendon

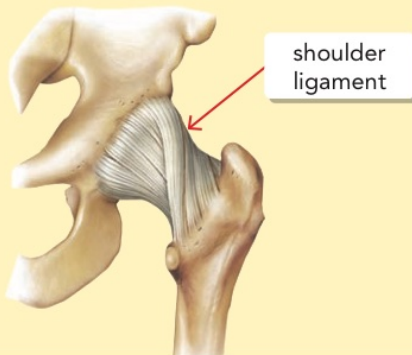


The Achilles tendon is the thickest and strongest tendon in the body. It measures about 15 cm long and joins the calf muscles to the bones in the foot.

Ligaments

Ligaments join the bones that are part of the joints and help to stabilise them. They also hold organs together, such as the eye or the uterus.

In general, they are not very elastic, and tear easily when they get too long.



The prevention of muscular system injuries

To maintain flexibility in muscles, tendons and ligaments, everyone should do regular stretching and sports, appropriate for their age.

Tendinitis is the inflammation of a tendon that causes pain when making a movement.

Ruptures or tears occur when muscle fibres break. These injuries are common in sports, although any effort can cause them, especially among sedentary people.

❷ How can we prevent muscular injuries?



► Understand, apply and reason

26. Find out how the Achilles tendon got its name. Why is this part of the body so important?
27. What is tendinitis? Create a factsheet about the causes of this problem and how to prevent it.
28. What shape are the orbicular muscles that surround the eye? Why is it important that they have this shape?

29. Write instructions for exercises that work each of the following muscles:
pectoral - abdominal - calf - biceps.
Then, read your instructions to a partner and see if they can guess which muscle they relate to.
- Lift your arms above your head...
- Bend your knees and...

Investigate how colours interact

Sometimes we say that we look at the world through rose-coloured glasses. Do you think this is really possible?

The primary colours (red, green and blue) do not derive from any other colours. But when we mix the primary colours, we get secondary colours. In this activity, we are going to see how primary colours vary and what happens when we mix them together.

Procedure

- 1 Look at the colours on the picture cards below. Then, create your own picture cards and collect objects of different colours. Try to use as many different colours as you can (including black and white). Look at all of the pictures and objects without using glasses, and make a note of the colours you see in a table in your notebook.
- 2 Next, make some cardboard glasses or use some that you already have.

Make four pairs of glasses with transparent lenses in the following colours: yellow, red, green and blue.
- 3 Look at the pictures and objects again. What colours are they now? Note the colours in your table.

Group structure: groups of 3 or 4 pupils

Functions or roles of group members:

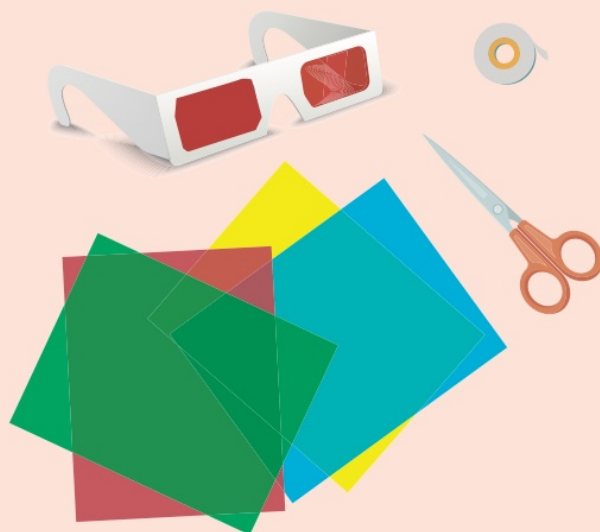
Coordinator: receives instructions from the teacher and manages time.

Speaker: shares information with the rest of the class

Secretary: is responsible for the group's written tasks.

Time: 45 minutes.

Material: colour pictures of different objects, objects of different colours, transparent coloured sheets in blue, yellow, green and red, template for cardboard glasses, scissors and sticky tape.



Results

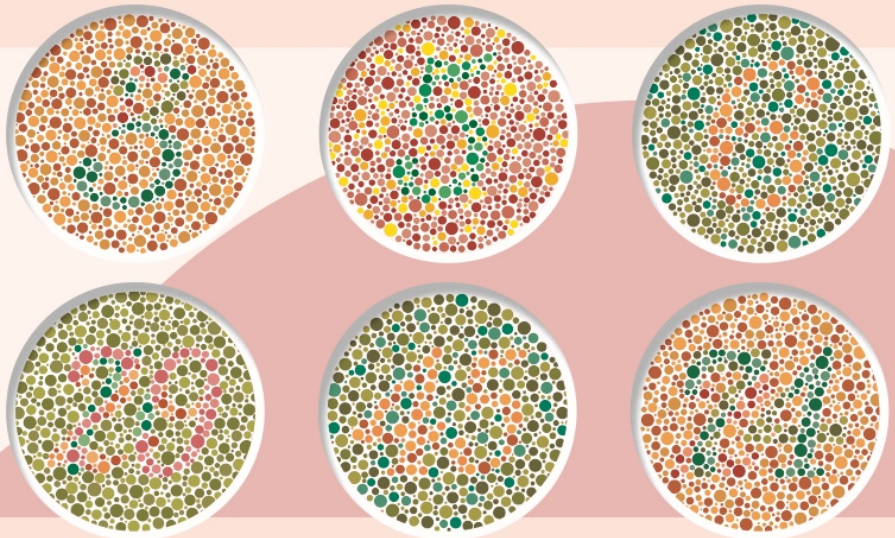
Colour without glasses	Colour with...			
	yellow glasses	red glasses	green glasses	blue glasses
Yellow	...	...	...	...
Red	...	...	...	...
Green	...	...	...	...
Blue	...	...	...	...
White	...	...	...	...
Black	...	...	...	...
Pink	...	...	...	...

What is colour blindness?

To do this activity, you need to be able to see all the different colours.

However, some people are **colour blind**, which means they cannot see them all.

To check if any of you are colour blind, you can do a simple test: read the numbers written in each of the circles on the right.



Analysis and conclusions

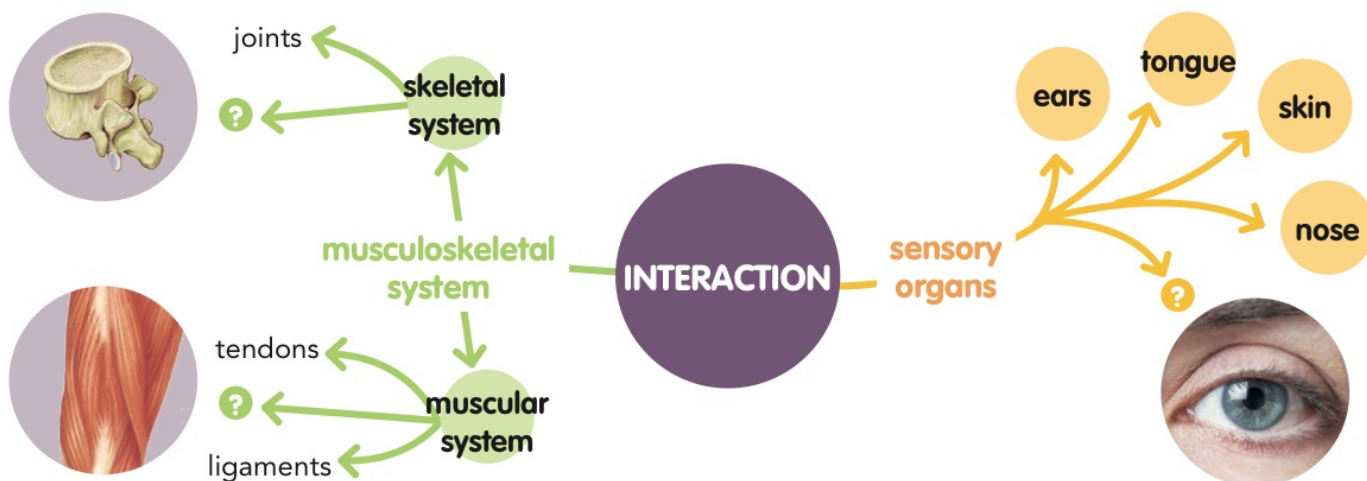
Compare all the groups' tables and create a summary table, using the data from the whole class.

- How do the colours change when you view them through different coloured filters?
- What does the colour yellow look like when you view it through a blue filter?
- Can you work out which are the secondary colours?
- Are any of the pupils in your class colour blind with all colours, or with one in particular?

Think and answer:

- What did you think of the activity?
- How many secondary colours did you discover?
- Did you learn any new names for colours with this activity?

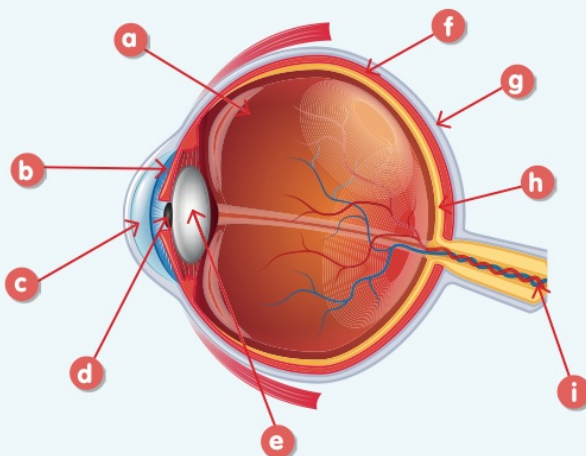
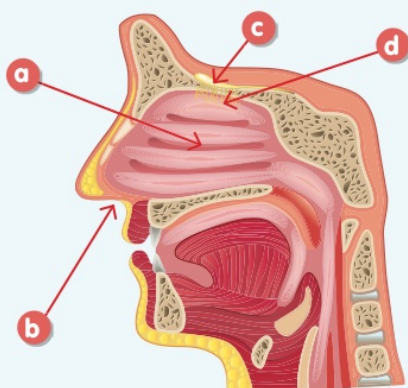
1. Copy and complete the concept map in your notebook:



2. Copy and complete the sentences in your notebook:

- The skin has receptors that respond to ..., temperature and
- The three layers that form the eye are the ..., the choroid and the
- The ear is divided into ... parts: the outer ..., the ... ear and the inner ear.
- The taste buds detect five flavours: bitter, sour, ... salty and
- The ... allows us to perceive smells. Olfactory receptors are found in the
- ... are the cells of the nervous system. They have short fibres called
- The skeleton consists of bones and
- The central nervous system responds to ... and ... actions.

3. Copy the diagrams into your notebook and label them:



Remember, it is important to go to the Gym to do some exercises.



- Complete each situation by putting the **verb** into the past tense, for example:
*If I **saw** a rat in my kitchen...*

Then, complete the sentence with an **infinitive verb**, for example:
*I would **scream**.*

- If I ... (**see**) a delicious fruit salad, my mouth would...
 - If I ... (**hear**) a loud bang, I would...
 - If I ... (**take**) a bite of a very hot slice of pizza, I would...
- Copy the following words into your notebook in columns under the headings:
shape, **texture** and **temperature**. Then, use the words to help you with activity 8 on page 11.

cold - hard - hot - irregular shaped - long - rough - round - short -
smooth - soft - square - warm

Example: *This object is irregular shaped and is hard and cold. I think it's a key.*

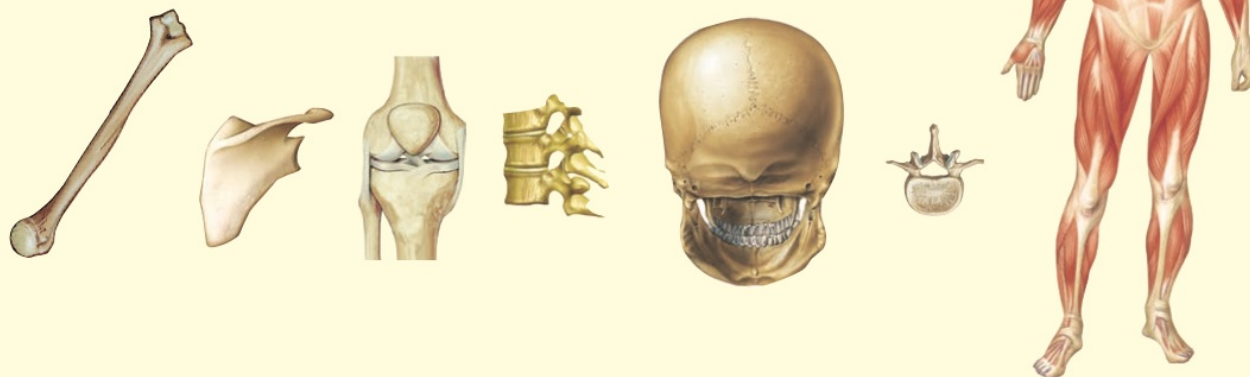


- Make superlative adjectives from the following list by adding -est to the end.
If the adjective ends in an 'e', remove it before adding -est:

small - strong - large - weak - hard - soft - short - long

Then, use them to talk about muscles and bones.

Example: *The femur is the longest bone in the human body.*



2 Human nutrition

Objectives

We are going to learn about:

- the organ systems involved in nutrition.
- the advantages of a healthy and balanced diet.
- the different functions of blood in the body.
- why exercise is important for the health of our circulatory and respiratory systems.
- how our kidneys work.

26

26

19 Useful language

- I really like (pasta) but I don't like (lasagne).
- (Running) is very good for our respiratory system.
- People need blood from other people when (they have a bad accident).
- The monk was trying to show (it is better to share than to be mean).

18 The story of the stone soup

A monk was travelling through the countryside when he started to feel hungry. He arrived in a village where the villagers were famous for being mean. When the monk asked for food, the villagers did not want to give him anything so he said:

"Well, I will make myself some stone soup".

He took a stone from his pocket and looked at it. The villagers laughed at the monk but he just said to them:

"Haven't you ever had stone soup before? It's delicious!"

The villagers were curious so they gave him a pot, some water and some firewood. The monk put the stone in the pot with the water and lit the fire. When the 'soup' was hot, the monk tasted it and said: "It just needs a little cabbage", so someone gave him a cabbage to add to the soup.

A few minutes later he said: "It just needs a little meat!" so someone gave him meat.

Finally, they also gave him potatoes, celery and sausage until he declared that the soup was perfect.

He ate a big bowl of soup and then invited the villagers to try it. They all had some and agreed that the stone soup was absolutely delicious.

When he finished eating, he picked up the stone, cleaned it and dried it and then put it in his pocket.

A villager then asked him: "Brother, will you come back and make us stone soup again?"

And he replied, "Yes, of course I will! I'll come back very soon". God bless you all!

Story by Anonymous (translated and adapted).

1. What do you think the monk was trying to show the villagers when he made his stone soup?

Think

- Every day you eat a lot of different foods:
 - Which are your favourite and least favourite foods?
 - What is the best type of exercise for our respiratory system?

Do you know?

- Name some healthy foods that we can eat a lot of.
- Why do some people need to receive blood from other people?

Reflect

- On some days we need to urinate more than on other days. Why does this happen? What factors influence our need to urinate?

The digestive system



The digestive system

The digestive system breaks down food into substances that blood can absorb. This process is called **digestion**.

The digestive system consists of the digestive tract and the digestive glands.

- What does the digestive system consist of?

Find and define:

- | | | |
|--------------|------------|--------------|
| • nutrient | • pancreas | • anus |
| • digestion | • liver | • intestines |
| • oesophagus | • secrete | • glands |

The digestive tract

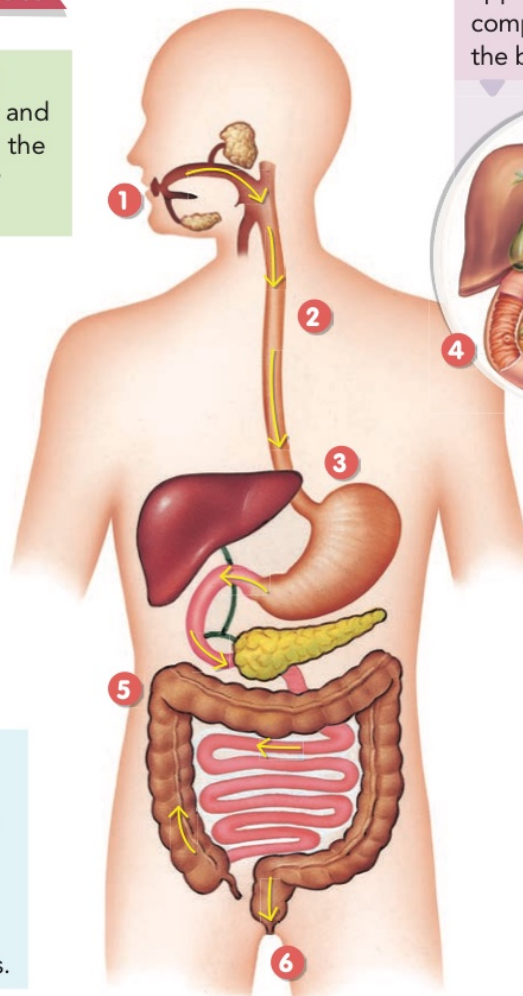
The **digestive tract** is a long tube, which goes from your mouth to your anus. It consists of different organs: the **mouth, pharynx, oesophagus, stomach, small intestine, large intestine** and **anus**.

The parts of the digestive tract

- 1 Your **mouth** is a cavity that contains your teeth, tongue and salivary glands. Food enters the digestive tract through your mouth.

- 2 When food is mixed with saliva, we swallow it and it passes to the **oesophagus**. Contractions in the oesophagus' walls push the food to the stomach.

- 3 The **stomach** is a muscular organ in the shape of the letter 'J'. It fills up as we eat and when it is full, our appetite decreases.
The partly digested food then passes to the intestines.



- 4 The **small intestine** is a tube approximately 7 metres long. Digestion is completed here and the nutrients pass into the blood.



Substances that have not been absorbed by the small intestine continue to the large intestine.

- 5 The **large intestine** is wider and shorter than the small intestine.

The longest part of the large intestine is the colon and it has the shape of an upside down letter 'U'. Inside the colon, there are different types of bacteria. Some of these bacteria produce substances that we need, such as vitamin K.

- 6 Faeces is made up of residue from undigested material. It leaves the body through the **anus**.

► Learn more: Digestive glands

Digestive glands make digestive juices and secrete them into the digestive tract.

There are two types of digestive glands:

- **Microscopic glands** on the **walls** of the **stomach** and the **small intestine**.

The stomach glands produce gastric juices and the small intestine glands produce intestinal juices.

- **Accessory glands**, which are outside the digestive tract. They are large, and secrete their juices into the digestive tract through different ducts.

Accessory glands include: the salivary glands which produce saliva, the liver which produces bile and the pancreas which produces pancreatic juices.

- | **b** What are the two types of digestive glands?

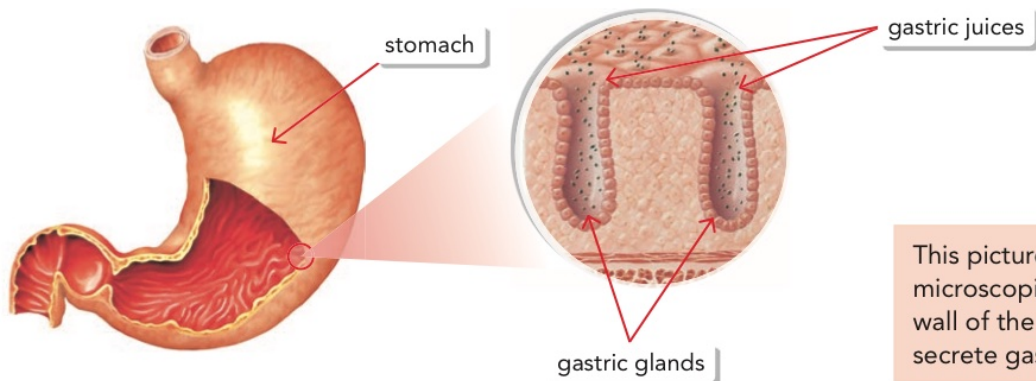
Types of glands

Glands are organs or groups of cells that make substances. They can secrete these substances externally, into the digestive tract or directly into the blood.

Glands that secrete outside of the body, such as sweat glands, or into the digestive tract, such as digestive glands, are called **external secretion glands**.

Internal secretion glands, such as the thyroid, secrete their substances directly into the blood.

Structure of the digestive glands



This picture shows us the microscopic glands on the wall of the stomach, which secrete gastric juices.

► Understand, apply and reason

1. **21** Are the following statements true or false?

Correct the false statements in your notebook. Then, listen and check:

- The digestive tract goes from your mouth to your pancreas.
- Nutrients are absorbed in the large intestine.
- The oesophagus is located below the stomach.
- The liver is not part of the digestive tract.

e) Food is completely digested in the stomach.

f) The longest part of the digestive system is the small intestine.

g) Waste material from digestion exits the body through the anus.

2. What is the function of the digestive glands in the digestion process? Which are the biggest glands and what substances do they produce?

The phases of digestion

The process of digestion consists of four phases: **ingestion** (when the food enters your mouth), **digestion** (when food is transformed into small particles), **absorption** (when the nutrients pass into the blood) and **defecation** (when undigested residue is eliminated from the body).

What are the four phases of digestion?

Find and define:

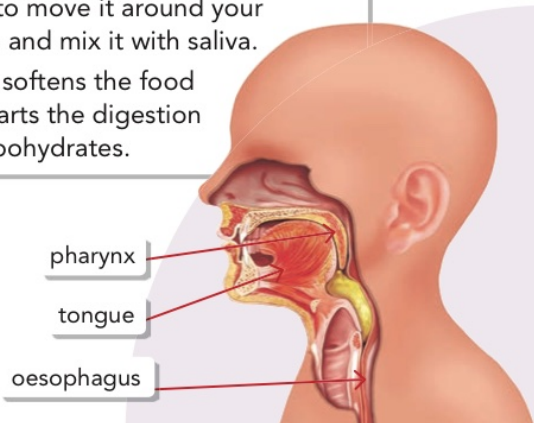
- | | | |
|--------------|------------------------|------------------|
| • ingestion | • mechanical digestion | • defecation |
| • absorption | • chemical digestion | • gastric juices |
| • chyme | | |

The digestive process

1 Oral digestion

When food enters your mouth, your **teeth** chew it and your **tongue** helps to move it around your mouth and mix it with saliva.

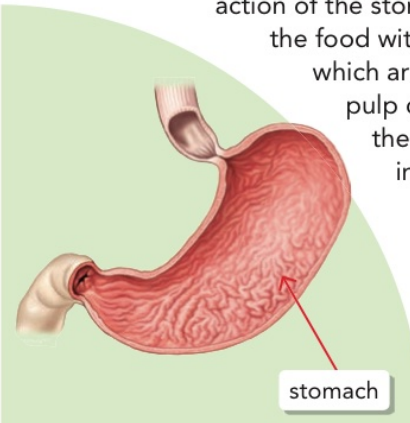
Saliva softens the food and starts the digestion of carbohydrates.



2 Digestion in the stomach

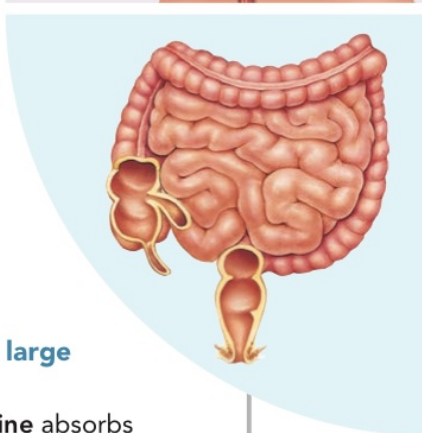
The food then passes through the **pharynx** and the **oesophagus** to the **stomach**. Here, the action of the stomach muscles mixes the food with **gastric juices**, which are very acidic, into a pulp called **chyme**. This then passes into the intestines.

Food stays in the stomach for about two hours. The digestion of proteins begins in the stomach.



4 The role of the large intestine

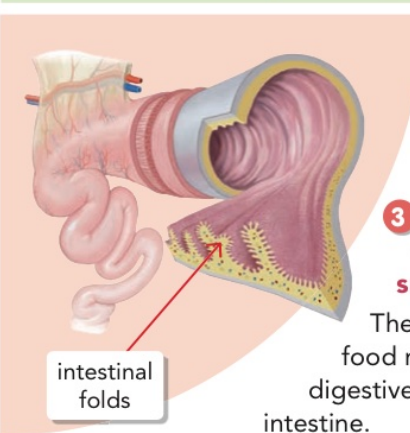
The **large intestine** absorbs water from food and digestive juices as well as mineral salts. It eliminates undigested material (or **faeces**) in a process called **defecation**.



3 Digestion and absorption in the small intestine

The partly digested food mixes with the digestive juices in the small intestine.

In the **small intestine**, the **chyme** breaks down into simple molecules called nutrients: carbohydrates, fats and proteins. These molecules pass into the blood in the process of **absorption**.

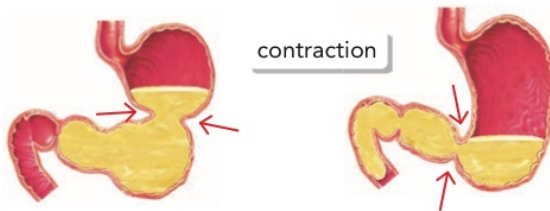


► Learn more: Types of digestion

Digestion is the result of two different processes: **mechanical digestion** and **chemical digestion**. Mechanical digestion begins in the mouth and ends in the stomach. While chemical digestion starts in the mouth but takes place mainly in the stomach and the small intestine.

Mechanical digestion

Mechanical digestion consists of cutting up and **grinding** the food and then mixing it with digestive juices. Our teeth and tongue, and contractions of the digestive tract **carry out** this process.



When the walls of the stomach or the intestines contract, the food moves through the digestive tract.

Chemical digestion

Chemical digestion transforms the large molecules from our food into simple molecules called nutrients, which our cells can easily absorb.

Digestive juices carry out chemical digestion.



The importance of brushing your teeth



If you want to chew your food well, it is important to look after your teeth.

Inside your mouth there are microorganisms that feed off food that is **stuck** between your teeth. This is why it is very important to brush your teeth after every meal.

Using dental floss every day is a good way to remove food from between your teeth.

Vocabulary

grinding: breaking down by pressure between two surfaces
carry out: perform; do **stuck:** not able to move

► Understand, apply and reason

3. Why is it important to chew your food well?
4. Where does chemical digestion begin?
5. Some people who suffer from obesity decide to have treatment to reduce the size of their stomach. Do you know why?
6.  23 Copy and complete the sentences in your notebook. Then, listen and check:
 - a) The ... system breaks down large food molecules into small pieces, called
 - b) The salivary ..., in your mouth, produce saliva, which softens food and breaks down
 - c) Protein digestion starts in the
 - d) Nutrients pass into the ... from the ... intestine in a process called

The circulatory system

The circulatory system consists of the **heart**, **blood vessels** (arteries, veins and capillaries) and **blood**.

- a What are the different parts of the circulatory system?

Find and define:

- | | | |
|-------------|--------------|----------------|
| • artery | • atrium | • plasma |
| • vein | • ventricle | • erythrocytes |
| • capillary | • leukocytes | • platelets |

The heart

The heart is the organ that pumps blood around the body.

The walls of the heart are made of muscular tissue and it is about the same size as a **fist**.

The **heart** is divided into four chambers:

- The two upper chambers are called **atria**. They receive blood from the veins.
- The two lower chambers are called **ventricles**. They push out blood through the arteries.

The heart is divided into two parts by a **wall** (septum).

There is an atrium and a ventricle on each side of this wall.

The blood on the left side of the heart contains more oxygen than the blood on the right side.

The two parts of the heart are connected by a **valve**, that lets blood pass from the atrium to the ventricle but stops it from returning.

- b Which chambers push blood out of the heart?

What are blood vessels?

Blood vessels carry blood around the body. There are three types:

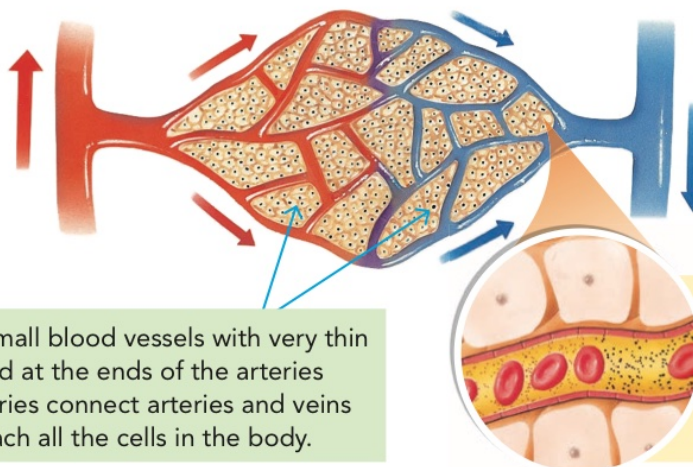
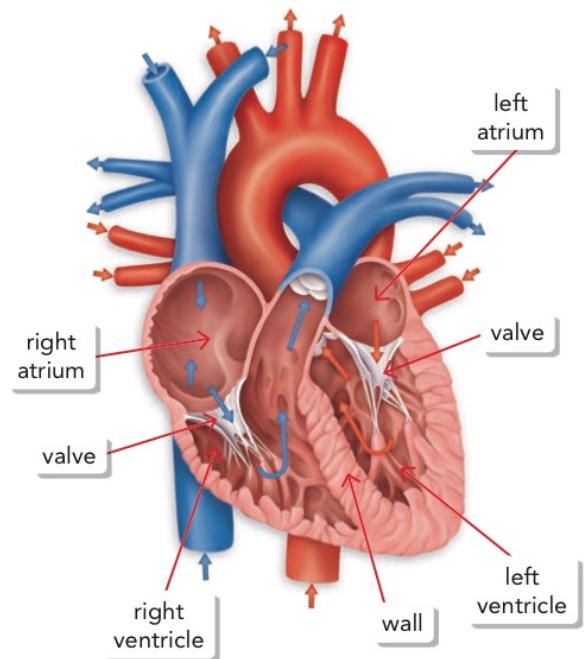
Arteries take blood from the heart to the capillaries.

Capillaries are very small blood vessels with very thin walls. They are located at the ends of the arteries and the veins. Capillaries connect arteries and veins together and they reach all the cells in the body.

Veins take blood from the capillaries to the heart.

All the connected capillaries form a network. This network takes blood to the cells and then takes it back to the heart.

The structure of the heart



► Learn more: Blood

Blood is a thick, red liquid which is made up of **blood plasma** and three types of cells: **erythrocytes**, **leukocytes** and **platelets**, which float in the blood plasma.

To find out more about blood, go to:

www.tiching.com/776217



Erythrocytes (red blood cells)

There are more erythrocytes than any other cell in our blood. They have a disc-like shape and they are red. They transport oxygen to our cells and transport carbon dioxide away from them.



Blood plasma

This is a translucent yellow liquid that mainly consists of water. It also contains dissolved nutrients from the digestive tract, which are taken by the blood to all the cells.

Leukocytes (white blood cells)

These cells are actually transparent, and they defend our body against illness. They do this by producing chemical substances that destroy microorganisms. When we have an infection, the number of leukocytes increases.



Platelets

These are very small cells that act when our blood vessels break (haemorrhage). When this happens, the platelets bond with other substances to form a **blood clot** and stop the haemorrhage.



Vocabulary

fist: closed hand

blood clot: solid mass of blood

► Understand, apply and reason

7. How many types of blood vessels are there? What are the differences between them?
8. In the diagram on the opposite page, the left atrium and ventricle are on the right of the picture. Why is this?
9. What is the function of platelets? Find out how they make blood clots.
10. What happens to the number of leukocytes

when we have an infection? Why?

11. Sometimes we see media campaigns that encourage us to give blood.

Use the Internet to find out about one of these campaigns. Are there situations when you must not give blood?

Find out what happens to the blood after it has been donated.

Blood circulation

The circulatory system takes nutrients and oxygen to all the cells in the body and takes waste substances away from the cells.

A double circulatory system

Blood always travels along the same path through blood vessels, following a **closed circuit**.

This is a **double closed circuit**, since the blood circulates twice through the heart to return to the starting point: once, when it goes to the lungs during **pulmonary circulation**, and again, when it goes to the rest of the body during **systemic circulation**.

- What are the two types of blood circulation?

Find and define:

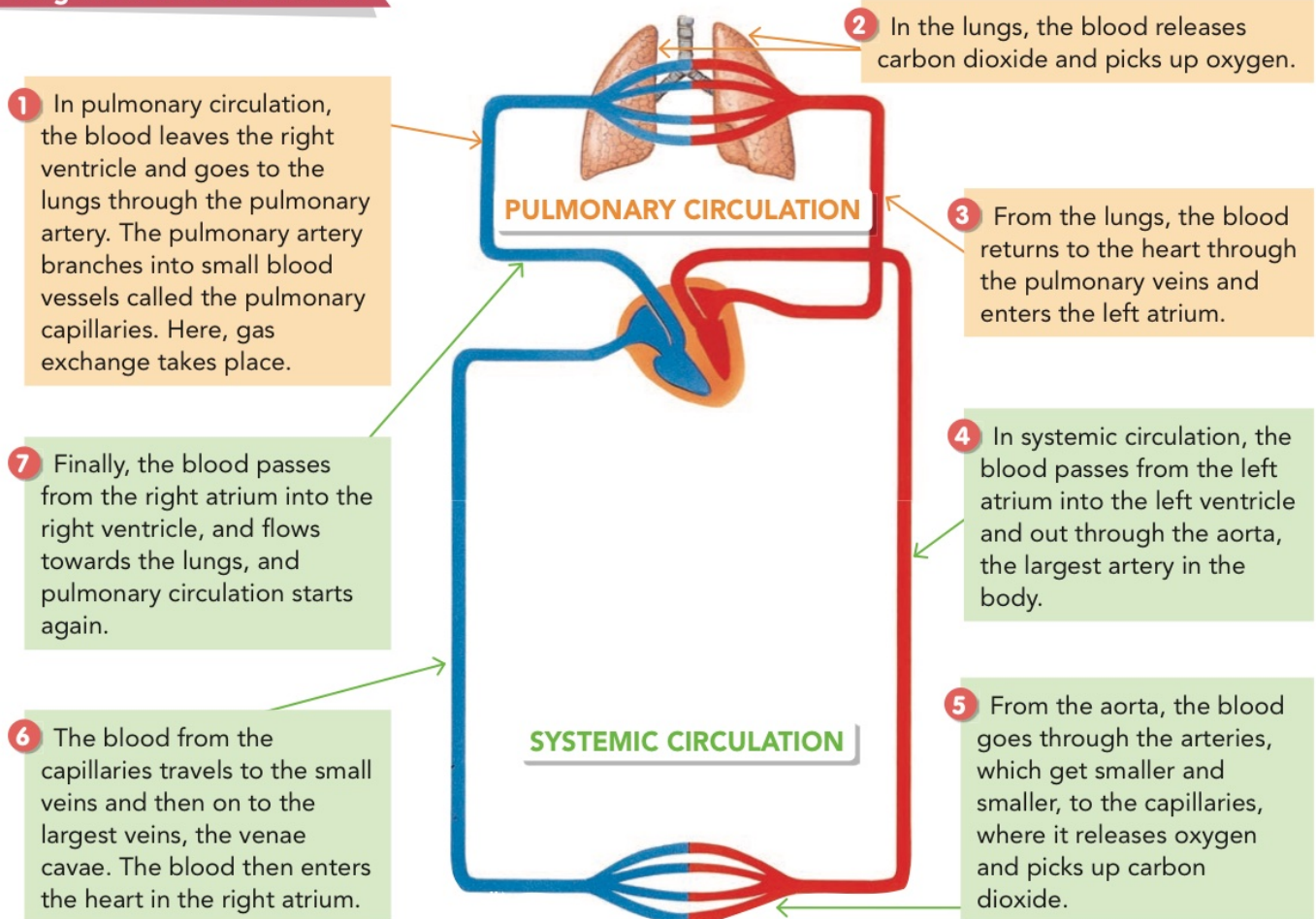
- pulmonary circulation
- systemic circulation
- aorta
- pulmonary artery

Two types of circulation

In the pulmonary circuit, the blood flows between the heart and the lungs.

In the systemic circuit, the blood flows between the heart and the rest of the body.

Diagram of blood circulation



► Learn more: How does the heart work?

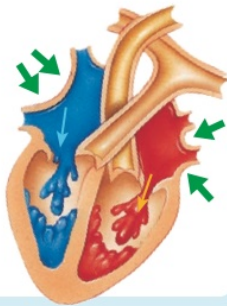
The heart pumps blood into the arteries every time one of its muscular walls contracts. Each contraction of the heart is called a beat. In young people, the number of beats per minute is usually between 70 and 90.

Find out more about the heart at:

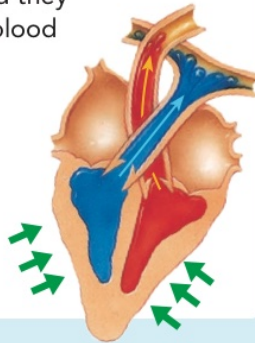
www.tiching.com/724524



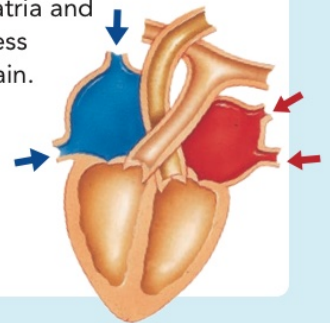
- 1 Blood enters the atria from the veins. The atria contract and pump the blood into the ventricles. This movement is called **atrial systole**.



- 2 Then, the ventricles contract in a process called **ventricular systole**, and they pump the blood into the arteries.



- 3 When the heart relaxes, in a process called **diastole**, blood passes from the veins into the atria and the process starts again.



The sounds of the heart

If you listen to someone's chest, you can hear the sounds their heart makes.

In each cardiac cycle, there are two sounds.

You can hear the first sound at the beginning of ventricular systole, when the valves that separate the atria from the ventricles close.

You can hear the second sound when the process of diastole begins.



► Understand, apply and reason

12. Make a fact sheet about the heart. Include a drawing and a description about what it looks like, its structure, and how it works.
13. The venae cavae and the pulmonary veins take the blood to the heart. Which atria are they connected to and what does the blood in these veins contain?
14. Calculate how many times your heart beats in one day and in one week.
15. Where does blood go when it leaves the heart via the left ventricle? And where is it going when it leaves the heart via the right ventricle?
16. Correct the following sentences in your notebook. Then, listen and check.
 - a) Blood circulates three times.
 - b) Our lungs deposit oxygen in our cells.
 - c) The aorta carries blood without oxygen.

The respiratory system

The respiratory system is made up of the **respiratory tract** and the **lungs**.

What is the respiratory tract?

Our respiratory tract connects our nose and our mouth to our lungs.

The respiratory tract includes the **nostrils**, **pharynx**, **larynx**, **trachea** and **bronchi**.

The bronchi are two branches at the bottom of the trachea. They divide into smaller branches (bronchioles) inside the lungs.

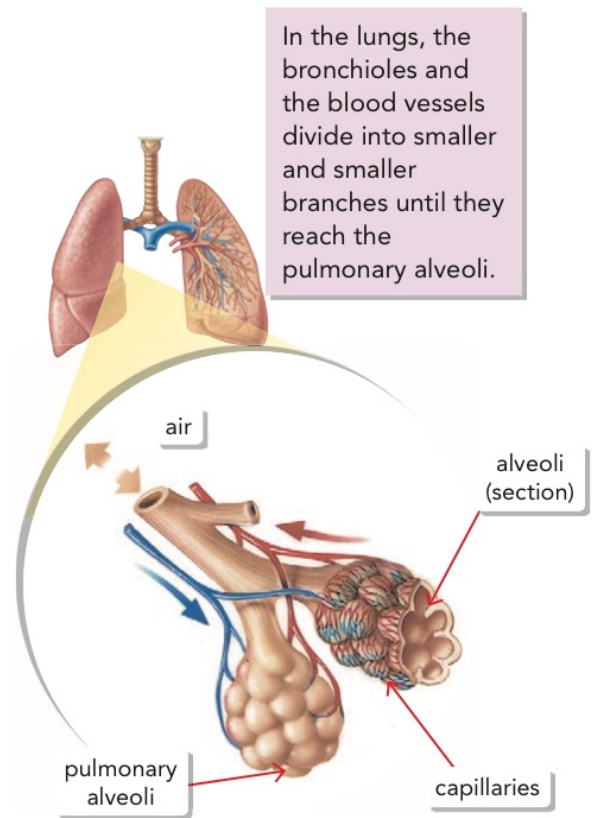
a What are the different parts of the respiratory tract?

What are lungs?

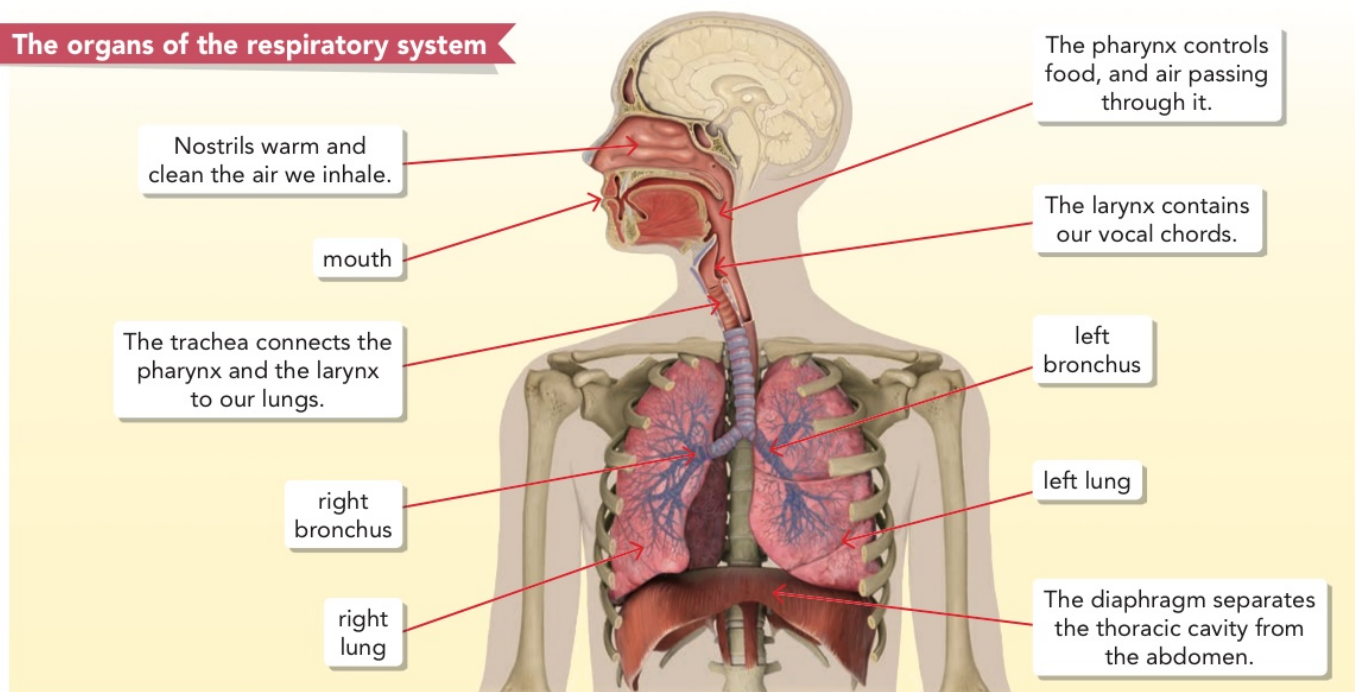
Our lungs are two spongy sacs, which are located inside the ribcage.

Inside the lungs, the bronchioles divide into millions of microscopic sacs called **pulmonary alveoli**, which is where gas exchange takes place.

b Where does gas exchange take place in the lungs.



The organs of the respiratory system



How do the lungs move?

The exchange of gases in the pulmonary alveoli takes place when we inhale and exhale using our lungs. Our body does these movements automatically.

The **diaphragm** and the **intercostal muscles** help the lungs to move.

The diaphragm is a large flat muscle which separates the thoracic cavity (thorax) from the abdomen. It is located under the lungs and it is connected to the thoracic cavity and the spinal column.

The intercostal muscles are located between the ribs.

- c** Where are the diaphragm and intercostal muscles located?

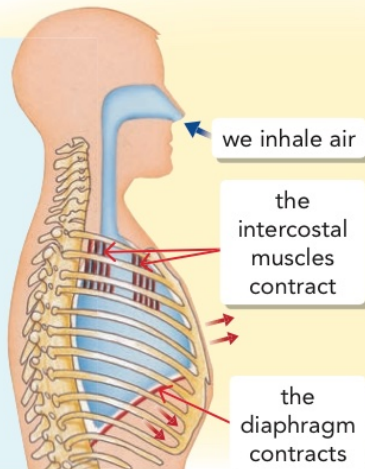
Find and define:

- | | | |
|---------------------|-------------|--------------|
| • pulmonary alveoli | • bronchus | • inhalation |
| | • diaphragm | • exhalation |



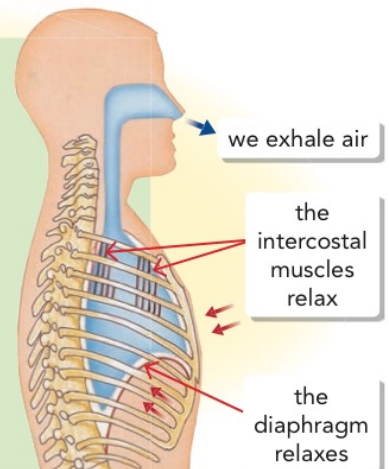
Inhalation

When we inhale, our diaphragm contracts and moves down. At the same time, the intercostal muscles contract and move up inside the thoracic cavity. As a result, the cavity around the lungs gets bigger. This allows the lungs to expand and the air can enter them.



Exhalation

When we exhale, our diaphragm and intercostal muscles relax. As a result, the chest cavity around the lungs becomes smaller. The lungs shrink in size and push out the air inside them.



► Understand, apply and reason

17. Put the following words into the correct order to show the passage of air into your lungs:
larynx - bronchus - mouth or nose - trachea
pharynx - pulmonary alveoli
18. Draw a diagram showing the parts of the respiratory system. Label the diagram and draw some arrows from the nose and mouth and ending in the lungs. You may want to colour in the different parts using different colours.

19. Our lungs are two very lightweight organs. Why is this?
20. What happens to your breathing after doing physical exercise? Do you know why this happens?
21. Is there a way of increasing the quantity of air we inhale?
22. Breathing is an automatic process. Can we consciously stop breathing?

gas exchange

Airflow

Air enters our body through the nose and flows through the respiratory tract until it reaches the lungs.

Oxygen from the air passes from the lungs into the blood.

At the same time, **carbon dioxide** passes from the blood to the lungs. The lungs then expel this gas via the respiratory tract.

a Which gases are involved in respiration?

Our nose cleans and moistens the air we breathe so that when it reaches the pulmonary alveoli, gas exchange can take place more easily.

Find and define:

- oxygen
- carbon dioxide
- cell membrane
- energy
- cellular respiration
- harmful



The exchange of gases when we inhale and exhale

The exchange of gases between our body and the outside air takes place in the **pulmonary alveoli**.

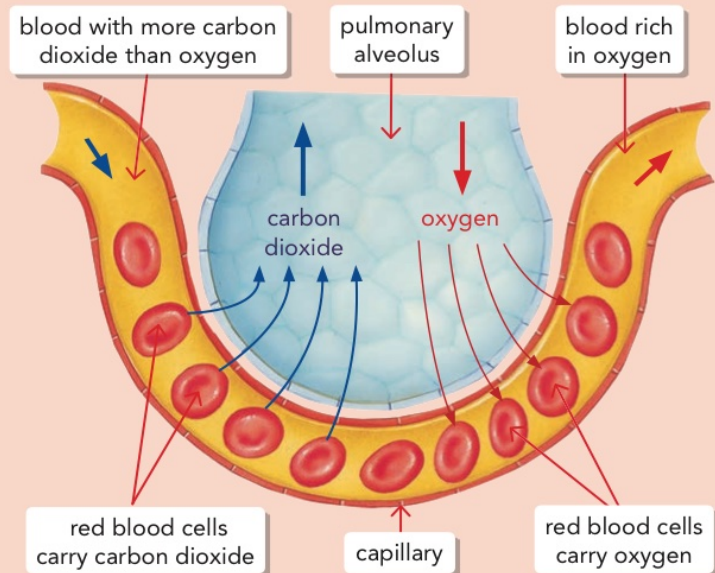
Oxygen from the air reaches the alveoli and passes into the blood through the blood capillaries that surround them.

At the same time, **carbon dioxide** passes from the blood into the alveoli and it is expelled from the body via the respiratory tract. The carbon dioxide travels in the opposite direction to the oxygen.

The **red blood cells** are located in the blood capillaries. They pick up oxygen and release carbon dioxide.

b What is the difference between the blood that reaches the alveoli and the blood which leaves them?

Gas exchange in an alveolus



The picture shows how gases are exchanged between the alveoli and the blood capillaries.

Cellular respiration

As we have seen, blood containing oxygen leaves the lungs, passes through the heart and then flows around the body via the capillaries.

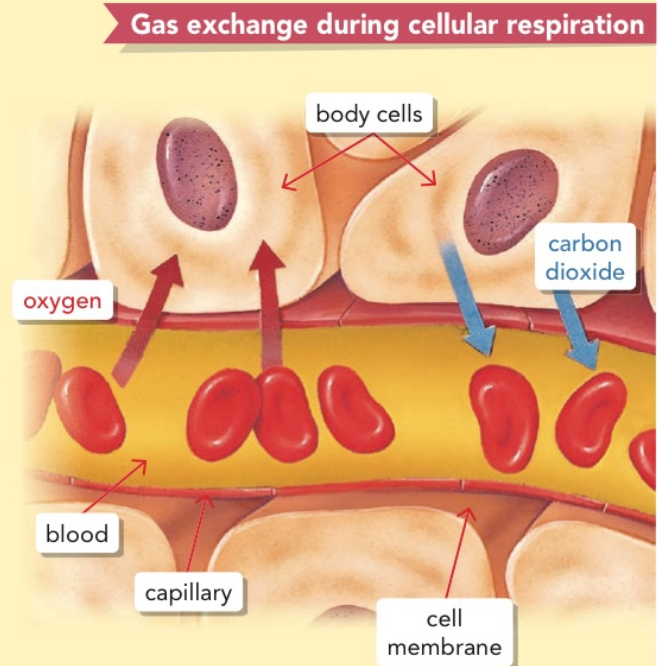
Oxygen reaches every single cell in the body through the capillaries.

In the cells, the oxygen combines with the nutrients from food to produce the energy that our cells need.

This process is called **cellular respiration**.

Carbon dioxide is released into the blood during cellular respiration as it is harmful to the cells. The blood takes the carbon dioxide back to the lungs and from there it is expelled into the air.

- c** What is the difference between the blood that reaches the cells and the blood which leaves them?



Rooms with poor ventilation

If the concentration of oxygen in the air that we breathe decreases, it is more difficult to obtain the oxygen that our body needs.

This is why we should avoid poorly ventilated spaces.



It is important to open the windows at home every day.

Understand and explain

23. Explain the flow of oxygen and carbon dioxide in the pulmonary alveoli.
24. The blood that enters the alveoli contains no oxygen. Is this statement true or false?
25. 28 Complete these sentences in your notebook. Then, listen and check:
Oxygen passes from the pulmonary ... to the ... blood cells in your bloodstream. It enters all the cells in your body and combines with ... to produce the ... that your cells need.
26. 29 Listen to the descriptions. Write down the things that are being described.
27. What are the health effects of air pollution in cities?
28. Use the Internet to find out about carbon dioxide poisoning. Give an example of when it could happen. How can we avoid it?

Excretion

Excretion takes place when the body eliminates waste products from the cells. The main excretory organs are the kidneys, which form part of the urinary system. Sweat glands can also excrete harmful substances.

a What are the main excretory organs?

The urinary system

The **urinary system** expels the waste products carried by the blood from the cells.

The urinary system consists of the **kidneys**, the **ureters**, the **bladder** and the **urethra**.

b What does the urinary system do?

How do our kidneys work?

We have two **kidneys**, located above the waist, on each side of the spinal column. Kidneys have a bean-like shape and they are about the size of a fist.

Our kidneys extract water and waste products from our blood, which are excreted from the body as **urine**.

Urine is produced in the kidneys by microscopic tubes called **nephrons**.

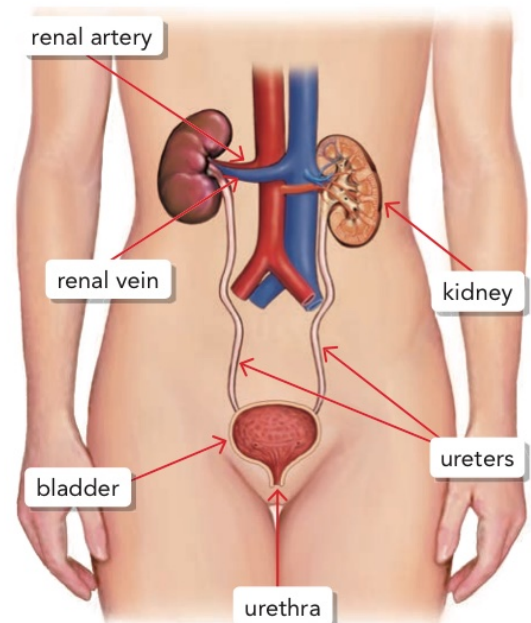
At the end of the nephrons there is a funnel-shaped chamber, which collects all the urine.

c What do our kidneys do?

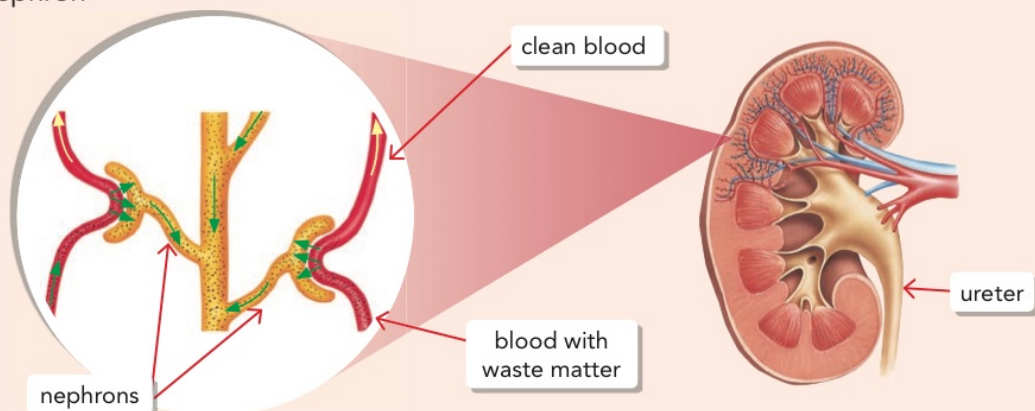
Find and define:

- excretion
- waste
- urine
- bladder
- mineral salts
- urethra
- sphincter
- dialysis

The urinary system



The end of each nephron is connected to an arterial capillary. The waste products pass from the blood into the nephrons.



The path of urine out of our bodies

The urine produced by our kidneys goes to two tubes called **ureters** (one for each kidney), which empty into our bladders.

The **bladder** is a hollow, elastic, muscular organ in the lower part of the abdomen. Urine from the kidneys collects here.

Our bladders can inflate like balloons and have a maximum capacity of 0.5 litres. When they are full, we must empty them.

A muscle called a **sphincter** closes the bladder's exit, but when the bladder is full, the sphincter relaxes and the urine can run out through a tube called the **urethra**.

In males, the urethra ends in the penis; in females it ends in the vulva, in front of the vagina.

- d What is the bladder?
- e What is the name of the tubes that lead to the bladder? And the one that leaves it? Where does this tube end?

Dialysis

Some people's kidneys do not work properly so they have to connect to a dialysis machine to stay healthy.

A dialysis machine receives the blood from the patient and removes the waste substances. It returns the cleaned blood to the patient.

The process of dialysis also eliminates other toxic substances from the body, such as urea, which is a harmful nitrogen compound.

Patients have to receive 3 or 4 sessions of dialysis a week.



Internet detectives

29. To find out more about your kidneys, go to:

www.tiching.com/776243:

- How much blood do your kidneys filter in one day?
- Your kidneys release hormones. What function do they have?
- How does blood enter your kidneys? And how does it leave?
- What do we call the clusters of tiny blood vessels that filter the blood?



Understand, apply and reason

30. ³¹ Correct these sentences. Then, listen and check:

- a) There are three kidneys in our bodies.
- b) Inside the bladder we can find nephrons.
- c) Nephrons filter water.
- d) The ureters take urine to the heart.
- e) The bladder stores gases.

31. Write a description of the path urine takes from when it is formed to when it is expelled.

32. What is the difference between the blood which enters the kidneys and the blood which leaves them?

33. What happens to a person whose kidneys do not work properly? What medical treatment do they need to stay healthy?

34. Our kidneys are continuously filtering the blood which flows around our body. However, urine is only usually expelled every few hours. Can you explain why this happens?

35. The urethra is longer in men than in women. What is the reason for this?

diseases related to nutrition and how to prevent them

Sometimes the organs from the digestive, circulatory, respiratory and urinary systems can stop working properly and cause disease. Here are some of the most common illnesses and how to prevent them:

Find and define:

- intolerance
- obesity
- allergy
- heart attack
- pneumonia
- kidney stone

Digestive system



Anorexia and **bulimia** are mental illnesses. Eating disorders can cause the sufferer to reject food or eat too much. It is important to receive treatment from a psychologist or a psychiatrist.

Food intolerances occur when part of the digestive tract rejects certain components of the food we eat. The most common food intolerances are caused by lactose and gluten.

Obesity occurs when a person's diet contains a large amount of sweet and fatty foods.



A **healthy diet** is important for all the systems in our body not just the digestive system.

We should eat a variety of different foods which give us the energy we need to carry out our daily activities.

Circulatory system

We should follow this advice to **prevent circulatory diseases**: control your blood pressure, do not smoke, avoid eating animal fats and do exercise at least three times a week.



Heart attacks and **strokes** are caused by an obstruction in one of the arteries that surround the heart or which take blood to the brain. When the cells stop receiving oxygen, they start to die.

Arteriosclerosis is a disease which is caused by the build up of fatty deposits such as cholesterol on the interior walls of the blood vessels. This causes the walls of the blood vessels to get harder and can lead to slow circulation, thrombosis, haemorrhages and even death.



Respiratory system

There are many **infectious diseases of the respiratory system**, which can have different health effects. The most common

respiratory illnesses are pharyngitis, the flu, pneumonia and bronchitis.

Asthma causes the bronchial tubes to narrow and get clogged which makes it difficult to breathe. Some types of asthma are caused by an allergy to a certain substance.

It is impossible to avoid all the **respiratory illnesses** that exist.

However, it is important to maintain some healthy habits such as breathing in through the nose, not smoking, and ventilating your home.



Urinary system

To help your kidneys work properly, it is important to drink lots of water and not consume too much salt.

By doing this, the **kidneys** can filter the blood more easily.

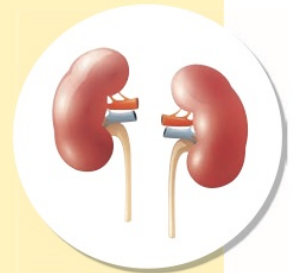


Kidney failure occurs when the kidneys cannot filter and clean the blood properly and waste substances accumulate in them.

It can be temporary or permanent.

Kidney stones form when crystals grow from the mineral salts found in urine.

Kidney stones collect in the urinary tract and cause intense pain as they can stop urine from leaving the body.



► Understand and explain

36. Find out if anyone in your family has suffered from any of the illnesses mentioned on these pages.

- Which member of your family was it?
- Did they recover from the illness?

37. Does anyone in your family smoke? What advice would you give them?

38. The law prohibits people from smoking in public places. Do you think this law is necessary? Give reasons for your answer.

39. Carry out a survey among your classmates to find out how much physical exercise they do every day. Ask them what exercise they do and how long they usually spend doing it.

design a healthy menu

A healthy diet is essential to maintaining our bodies in good health. To eat healthily, we should eat a variety of foods during the day and enjoy every meal.

To find out more about healthy eating go to:

www.tiching.com/679210



I understand the ingredients of a healthy meal

1 Which foods do I need for a healthy meal?

Food can be divided into five major groups, depending on the nutrients it contains and their functions.

Milk and dairy products

These are very nutritious foods because they contain protein, sugar, fat and vitamins.

Cereals

Food made from cereals give us energy. We often make these foods from wheat.

Fruit

Fruit and fruit juice contain water, sugar, fibre and vitamins.

Meat, fish and eggs

This group also includes pulses. Meat, fish and eggs contain a lot of protein.

Vegetables

Vegetables contain vitamins and vegetable fibre. It is good for you to eat them raw.



Examples of portion sizes

Number of daily, recommended portions of each food group

Cereals	4-6
Fruit	2-3
Vegetables	2-3
Dairy products	2
Meat, fish and other foods containing protein	2



2 How to prepare a daily healthy menu

1. First, copy the table below into your notebook and complete it with the different foods that you would like to eat for each meal or snack.
2. Use the examples of portion size on page 44 to calculate approximately how many portions you will eat of each type of food.
3. When you have completed the table, check that your diet follows the daily recommended portions guide.
4. If the number of portions is less or more than the recommended amount, you should adjust your calculations.
5. Finally, it is important to remember to enjoy meal times. Think about the best way to prepare the food you have selected.

My healthy diet by _____

Meal	Food	Group	Portions
Breakfast			
Morning snack			
Lunch			
Afternoon snack			
Dinner			



Apply what I know

40. Give some examples of foods from each of the five major food groups.
41. Which is your favourite food group?
42. Are there any foods that do not belong to the five major food groups?
43. **LS₃** Do you remember what you ate yesterday? Make a similar list to the one above of all the food you ate. Did you eat enough of the daily recommended portions? Get into groups of four and tell the other pupils about what you ate.

Recovery time after physical activity

Our body's systems are adapted to the different situations in which we find ourselves. This activity will allow you to check it.

1 Get into groups

Get into groups of four. Each member of the group will have a different responsibility: one member of the group will do some physical exercise. The second and third members of the group will count the number of heartbeats (heart rate) and respiratory cycles (breathing rate) of the pupil doing the exercise. The last member of the group will be in charge of the stopwatch and will write down the results.

Group structure: groups of 4 pupils.

Functions or roles of group members:

Coordinator: receives the instructions from the teacher and is in charge of the time.

Speaker: shares information with the rest of the class.

Secretary: is responsible for the group's written tasks.

Time: two sessions.

Material: receives stopwatch, paper and pen.

2 Measure the heart rate and the breathing rate

Check to see if anyone in your group has a sports watch because they have a built-in stopwatch and can also measure your heartbeat.

You can also measure your classmate's pulse manually. The best places to take someone's pulse are the inside of the wrist or at the base of the neck because there are arteries located under the skin. Press two fingers lightly on the wrist or neck and count the number of pulsations during one minute.

To calculate the breathing rate, you should count the number of times your classmate inhales and exhales in one minute.



3 Do some intense exercise

The first and second group members should now measure the heart and breathing rate of the member who is going to do the exercise. Then, this pupil does the exercise that your teacher tells you to do. This could be running in a race, or running up and down some stairs.



4 Measure the heart rate and breathing rate after exercise

When your classmate finishes the activity, measure their heart and breathing rates again. Repeat this process 5, 10 and 15 minutes after they finish doing the exercise.

5

Compile your data in a table

Copy these tables into your notebook and write down the results from your experiments:

Group	Heart rate while resting	Heart rate after exercise	Heart rate 5 minutes later	Heart rate 10 minutes later	Heart rate 15 minutes later
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	...	...	...	...	...
7	...	...	...	...	...

Group	Breathing rate while resting	Breathing rate after exercise	Breathing rate 5 minutes later	Breathing rate 10 minutes later	Breathing rate 15 minutes later
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	...	...	...	...	...
7	...	...	...	...	...

Think and answer

- Which classmate has the lowest breathing rate?
- Which classmate has the lowest heart rate?
- What are these two classmates like? Are they the tallest in the class or the shortest or lightest in the class? Describe them.
- Look at the heart and breathing rates of your classmates after exercise. Which of your classmates took less time to reach the same heart and breathing rates as they had before doing the exercise?
- Now ask the classmate who took the least time to recover after physical exercise if they do any exercise on a daily basis or if they do any sport.

1. Write an essay:

- Write a short essay about the food you eat with your family. Include the types of food you eat when you are all together and describe what your favourite family meal is.
- You should include these words in your essay: *vegetables, fruit, meat, grains, milk and eggs.*

2. Copy and complete these sentences in your notebook:

- | | |
|---|--|
| a) The digestive tract is a long tube which goes from your ... to your | f) Blood returns to the heart through the |
| b) The digestive gland that produces bile is called the | g) The blood cells which defend our body against illness are called |
| c) The ... intestine is about seven metres long. | h) Our heart has four chambers: two ... and two |
| d) The actions of our teeth and ... , and contractions in the digestive ... help the process of mechanical digestion. | i) Air enters our lungs during the process of ... and leaves our body during |
| e) To have a healthy ... we must eat a ... of different foods. | j) ... is produced in the kidneys and expelled from the body via the bladder. It is made up of water and waste substances. |

3. Which body system do these statements refer to?

- a) High blood pressure is an important risk factor.
- b) Isotonic drinks help you to recover mineral salts after you sweat.
- c) It is important to brush your teeth after every meal.
- d) Smoking is harmful to your health and to those around you.
- e) You should eat fruit and vegetables every day.
- f) Exercise is good for our heart..

4. Match the definitions to the names of parts of the body on the right. Note that two of the names do not have definitions:

- | | |
|--|----------------------|
| a) They transport oxygen to our cells. | 1) kidneys |
| b) They extract water and waste from our blood. | 2) accessory glands |
| c) A muscle that closes the bladders exit. | 3) ventricles |
| d) The liver and pancreas are examples of these. | 4) sphincter |
| e) The two lower chambers of the heart. | 5) red blood cells |
| f) Oxygen enters the blood from these. | 6) white blood cells |
| | 7) lungs |
| | 8) atria |

Remember, it is important to go to the Gym to do some exercises.



- Copy the questions into your notebook and choose the correct option. Then, ask and answer the questions with another pupil:

- Is the small intestine longer **as** / **than** / **of** the large intestine?
- What accessory glands do we have **outside** / **out** / **away** the digestive tract?
- What does the chyme mix with **on** / **at** / **in** the small intestine?
- What do we call the wall that divides the heart **into** / **to** / **for** two parts?
- Which blood vessel carries blood **to** / **from** / **between** your lungs to your heart?

- Copy the dialogue into your notebook and put Marc's comments in the correct places. There is one extra answer. Then, practise the conversation with a partner:

Laura: Hi, Marc! How are you?

Marc:

Laura: Oh great! What news is that then?

Marc:

Laura: Oh, that is good news. That'll be much better for his health. Why did he decide to stop now?

Marc:

Laura: Oh dear. Is he very ill then?

Marc:

Laura: Well, I'm sorry your uncle's ill but I'm happy if it helps your dad to get healthy.

Marc:

a) I'm fine thanks, Laura. Actually, I've just had some good news.

b) I don't like cigarette smoke.

c) I think he'll be all right. He had problems breathing but he's getting better. But my dad decided then that he'll stop smoking before it happens to him.

d) Yes. Me too.

e) Well, he wanted to stop ages ago but last week he visited his uncle in hospital.

f) My dad has finally given up smoking.

- Talk in groups of four about what you had to eat yesterday. Use these sentences to help you with activity 43 on page 45:



3

How is a human life created?

Objectives:

We are going to learn about:

- characteristics of human sexual reproduction.
- male and female reproductive systems.
- the difference between fertilisation, pregnancy, and birth.
- the changes that occur to the foetus during pregnancy.
- the different stages of life of a human being.

35 Useful language

- We need to clean and take care of our reproductive organs so (that they are healthy).
- I think (infancy) is the easiest because (someone else looks after you).

34 Pregnancy and babies

It is amazing how a miniscule ball of cells called an embryo can grow so much and become a baby. But it is true. During the nine months of pregnancy, these cells divide billions and billions of times inside the woman's uterus until they become a baby. Pregnancy is the time the embryo needs to become a foetus, develop, and be born.

While the foetus is growing, it does lots of things. It slaps and punches. It kicks. It can even do somersaults. It sucks its fingers, especially its thumb. It moves its mouth, swallows water, and opens and closes its eyes. It stretches and sleeps. It also makes noises, like burps or hiccups.

The foetus can also hear. It hears the voice of its mother, the noises of her stomach and the beats of her heart.

If it hears a loud noise, or senses a strong light through its mother's belly, it can get agitated. The mother can feel the foetus moving after four or five months of pregnancy. Pregnant women can tell when the foetus is moving and when it is still.

Robie H. HARRIS: *¡Es alucinante!*.
Barcelona, Ediciones Serres, 1999 (translated and adapted).

1. What is pregnancy? How many months does it last? What happens to the cells during this time? What does an embryo become?
2. What does a foetus do in its mother's uterus? When can a mother start to feel the movements of the foetus? Have you ever felt a baby move inside its mother's belly?

Think

- What is an egg? And a sperm? Where are they produced?
- What is the name of the stage of life when adolescence starts and big physical and emotional changes take place?

Do you know?

- Do you want to know why women menstruate every month?
- Did you know that technology is so advanced that we can see an almost perfect image of the foetus during pregnancy?

Reflect

- Why is it important to clean and take care of your reproductive organs?
- Do you think one stage of your life is easier than other stages? Which one?

How do humans reproduce?



Sexual reproduction

Reproduction is the process that organisms use to create offspring. Humans are mammals and they reproduce sexually.

What is sexual reproduction?

In **sexual reproduction**, two individuals of different sexes participate. The offspring are similar to their parents.

- **Male humans** are called **men**. They produce **sperm**, which are the male sex cells.
- **Female humans** are called **women**. They produce **eggs**, which are the female sex cells.

a What do men and women produce in the process of sexual reproduction?

What differences exist between the sexes?

Men and women are distinguished primarily by:

- **primary sexual characteristics.** These are the organs and other structures that form a part of the male and female reproductive systems.
 - **secondary sexual characteristics.** These are other characteristics that help us tell the difference between men and women. For example, women develop breasts, have lower muscle mass and a higher voice. Men have more hair on their bodies, more muscle mass, and deeper voices.
- b What are the secondary sexual characteristics of men and women?

Find and define:

- | | |
|-------------------------|-----------------------|
| • sexual characteristic | • egg |
| • sperm | • sex cell |
| • testicle | • reproductive system |
| • penis | • vas deferens |
| • urethra | • prostate |

What are sex cells like?

- An **egg** is a large, spherical cell. It is immobile and stores nourishment in its cytoplasm.
- **Sperm** are small cells. They have a tail, which helps them move so they can reach the egg.



Understand, apply and reason

- Which organs correspond to the primary sexual characteristics of men and women?
- What are the differences between the two kinds of sex cells? Why do sperm have tails?
- Look at the images of the male reproductive system:
 - What organs make up this system?
 - What organ makes up part of both the reproductive system and the urinary system?
 - What function does the prostate have?
- What organ in the image is not part of the reproductive system?
- Explain the path that sperm take from the organ where they are created until they leave the penis.
- In humans the differences between the sexes are quite easy to see, but this is not true for other species of animals. Look online. Find two species where there is virtually no visible difference between males and females, and two species other than humans where the differences are easy to see.

► Learn More: What is the male reproductive system like?

The male **reproductive system** has two functions: to produce **sperm**, and to deposit the sperm inside the female reproductive system.

The two most important organs in this system are the **testicles** and the **penis**. Both are outside of the main part of the body and are located in the lower abdomen.

❶ What are the functions of the male reproductive system?

Care of the male reproductive system

Good hygiene and habits (for example, taking a daily shower) are very important for keeping the male reproductive system healthy and to prevent illness and infection.

Parts of the male reproductive system

Front view

The **vas deferens** connect the penis and the testicles.

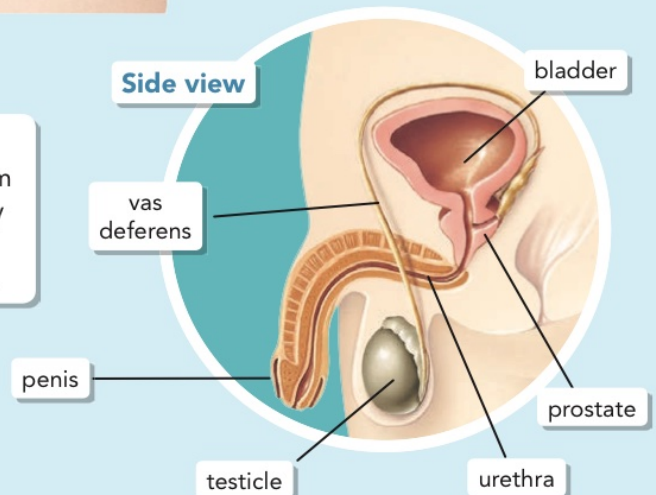
The **testicles** are two small round organs, which are covered in skin and located under the penis. Starting in puberty, each testicle constantly makes a large quantity of sperm.

The **prostate** is a gland that makes a liquid that functions as food and transport for the sperm.

The **penis** is a cylindrical organ. The **urethra** is located inside the penis. Sperm are ejaculated from the penis.

The **urethra** permits the sperm to leave the body without being mixed with urine.

Side view



Find out more about the male reproductive system at:

www.tiching.com/724155



What is the female reproductive system like?

The female reproductive system has two functions: to produce eggs and to protect and nourish new life if fertilisation occurs.

The organs that form the system are in a woman's lower abdomen. They are: the **ovaries**, the **Fallopian tubes**, the **uterus**, the **vagina** and the **vulva**.

- What are the functions of the female reproductive system?

Find and define:

- ovary
- fallopian tubes
- uterus
- vagina
- vulva
- ovulation
- menstruation
- reproductive cycle

Parts of the female reproductive system

Front view

The **ovaries** are two round organs that are about the size of an almond. This is where eggs are formed. Starting in puberty, each month, one ovary releases an egg, which then travels to a Fallopian tube. The ovaries alternate this function from month to month.

The **vagina** is an elastic duct that connects the uterus to the vulva on the body's exterior.

The **Fallopian tubes** are two muscle ducts that connect the ovaries to the uterus.

The **uterus** is a type of sack with muscular walls. This is where the new life lives until it is born.

The **vulva** is the external part of the female reproductive system. It consists of folds of skin that cover the opening of the vagina.

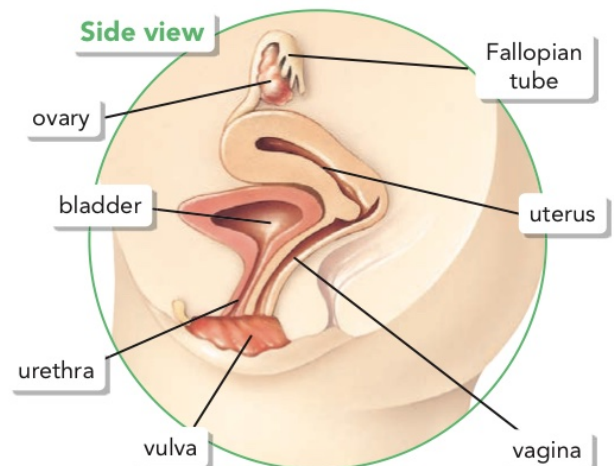
The vulva also protects the part of the urethra where urine passes out of the body.

- After puberty, how many eggs do the ovaries of a woman release each month?

Care of the female reproductive system

It is very important to take proper care of the female reproductive system, especially during menstruation. It is also important to pay close attention to the dates that menstruation starts and finishes, as well as the length of the cycle. This helps identify any possible problems or a possible pregnancy.

Side view

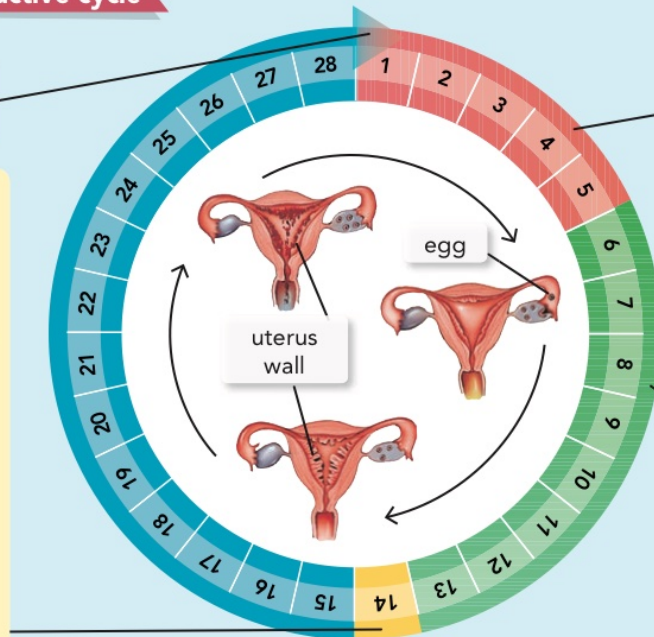


► Learn More: What is the female reproductive system like?

During the **reproductive cycle of a woman**, different processes and changes happen in the ovaries and the uterus. This cycle usually repeats every **28 days**, although the exact duration for each woman can vary because of internal and external factors.

Stages of the female reproductive cycle

- 1 The reproductive cycle starts when menstruation starts.
- 4 Near the middle of the cycle, the ovaries release an egg. This process is called ovulation:
 - If the **egg is not fertilised** within 14 days, it is expelled from the body during menstruation.
 - If the **egg is fertilised**, an embryo forms. The embryo implants itself in the wall of the uterus and periods stop during pregnancy.



- 2 During **menstruation**, also known as a woman's **period**, the egg leaves the body together with a superficial layer of the **lining** of the uterus. This layer is full of blood vessels and this blood is **discharged** during menstruation.

- 3 After the period, the blood vessels reform and rebuild the superficial layer of the lining of the uterus.

Vocabulary

lining: inside layer **discharged:** released

- c How long is a normal reproductive cycle in women?

► Learn, apply and reason

6.  Copy and complete the sentences in your notebook. Then, listen and check:
 - a) The female reproductive system produces ... and protects and nourishes new life if ... occurs.
 - b) The Fallopian tubes connect the ovaries to the
 - c) The ... connects the uterus to the vulva.
 - d) Eggs are produced in a woman's
7. What is the difference between menstruation and ovulation?
8. Why does a woman lose blood during her period?
9. Make a chart that identifies the organs in the female reproductive system, whether they occur in pairs or as a single organ, and their functions.
10. A young woman's period starts on 4 June. What day of the month will she ovulate (approximately)? What day will she have her next period, if her cycle is regular?
11. The reproductive cycle of a woman not only causes physical changes in her body, but also emotional ones. Have you ever experienced this? Did you feel supported by the rest of your class or your family? Do you think this topic should be talked about more openly?

fertilisation, pregnancy, and childbirth

A baby can only be born after a series of processes. It begins with **fertilisation**, continues with **pregnancy** and ends with **childbirth**.

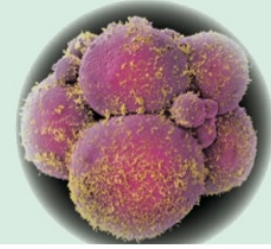
Find and define:

- fertilisation
- zygote
- embryo
- umbilical cord
- foetus
- navel

How does fertilisation happen?

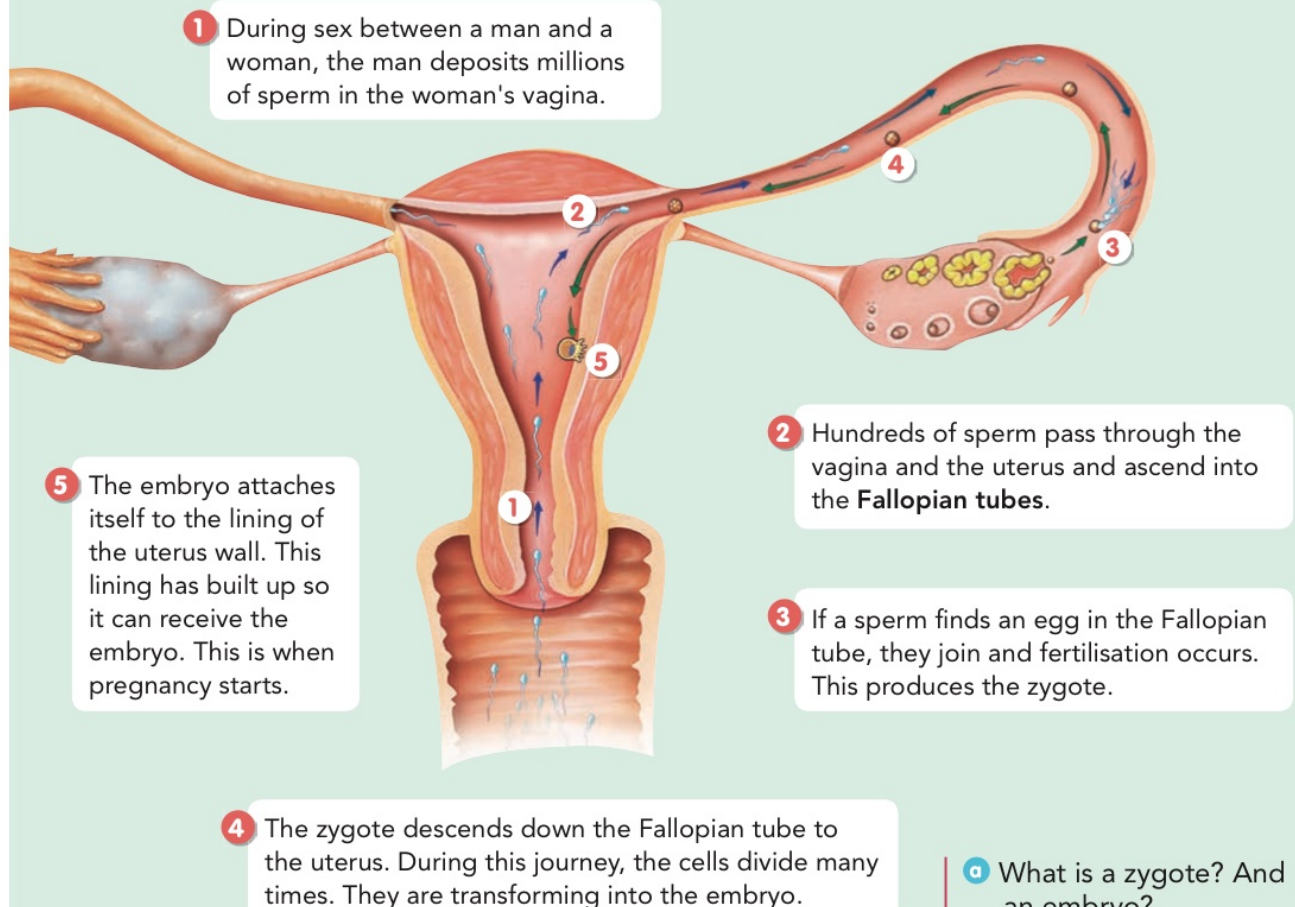
Fertilisation happens when a sperm and egg come together. This process generates the first cell of the new life. This cell is called a **zygote**. After a series of transformations, the zygote becomes an **embryo**.

Pregnancy begins when the embryo attaches itself to the lining of the uterus wall.



An embryo five days after fertilisation. Viewed with an electron microscope.

Stages of the formation of the zygote and embryo



• What is a zygote? And an embryo?

What changes take place during pregnancy?

Pregnancy is the approximately nine-month period from when the embryo attaches itself to the uterus wall until the birth of the baby.

The embryo separates itself from the lining of the uterus wall after a few days. It stays connected to it via the **umbilical cord**. Nourishment and oxygen circulate from the mother to the embryo through this cord. Waste (urine and faeces) move from the embryo to the mother along the cord so the mother can eliminate them.

Near the end of the second month, the embryo looks more like a baby. It is now called a **foetus**.

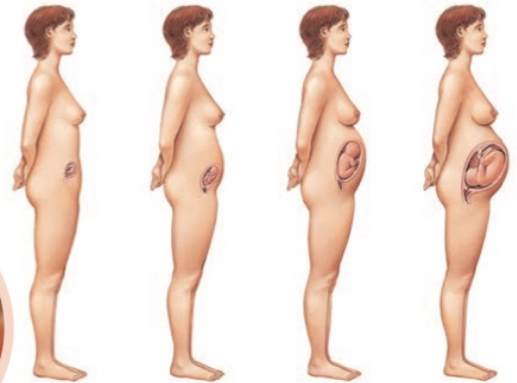
- b** What connects the foetus to the uterus wall?

Nowadays, there are very advanced methods to monitor pregnancy, such as **ultrasound** imaging in 3D, 4D and 5D.



Stages of pregnancy

1 month 3 months 6 months 9 months



What happens during birth?

When the foetus is ready to be born, it leaves the body via the vagina during **birth**.

During birth, the lower part of the uterus (cervix) gradually expands to let the baby pass through. It then contracts so the baby can come out. Usually the head comes out first, followed by the rest of the body.

- c** What part of the baby usually comes out first?

Once the baby is born, the umbilical cord is **clamped** and cut. The **stump** then dries and falls off. The baby is left with a scar that is the **navel**, or belly button.



Vocabulary

clamped: pressed together

stump: the remaining part after something is cut off

Learn and explain

12. What path does sperm take inside the female reproductive system so that fertilisation can take place?
13. What is the function of the umbilical cord? What is the navel?
14. Explain the difference between an embryo and a foetus.
15. What does it mean if you see two foetuses in the same ultrasound?



Web detectives



16. Listen to the heartbeat of a foetus at www.tiching.com/773279 and answer the questions:
 - a) How many heartbeats per minutes (heart rate) can you hear? What is your heart rate?
 - b) Look on the Internet to find out why a foetal heart rate is like this.

study the development of a human being during pregnancy

The growth of a foetus is not the same during all nine months of pregnancy. On this page, you will identify and measure the changes in the foetus that take place each month, and represent the growth throughout the whole process.

Find out more about how a foetus becomes baby at:

www.tiching.com/777437



Learn how a baby forms

1 How do the embryo and the foetus develop?

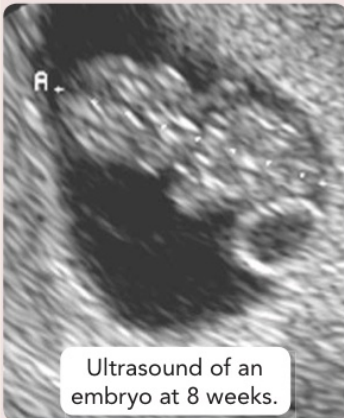
The growth and development process of the embryo takes place over 40 weeks, divided between the **embryonic stage** and the **foetal stage**.

The embryonic stage

During the first two months of pregnancy, the embryo grows from 0.1 mm to 3 cm and the main bodily systems start to form. For example, you can

hear the first heartbeats around day 21.

Around the fourth week, the head takes shape and the outlines of the limbs appear. At the end of this period, the embryo weighs more than 1 g, has a heart, and becomes a **foetus**.



Ultrasound of an embryo at 8 weeks.

The foetal stage

Near the end of the third month of pregnancy, the sex of the foetus can be identified. The foetus measures about 10 cm long and now looks human.

At five months, all of the organs have formed and the foetus measures 30 cm. After six months, the foetus is viable, its eyes open and close and its movements are more precise.

In the last six weeks of pregnancy, the foetus grows and becomes heavier. At the end of this period, it measures about 50 cm and weighs about 3.3 kg.

Ultrasound of a foetus at 12 weeks.

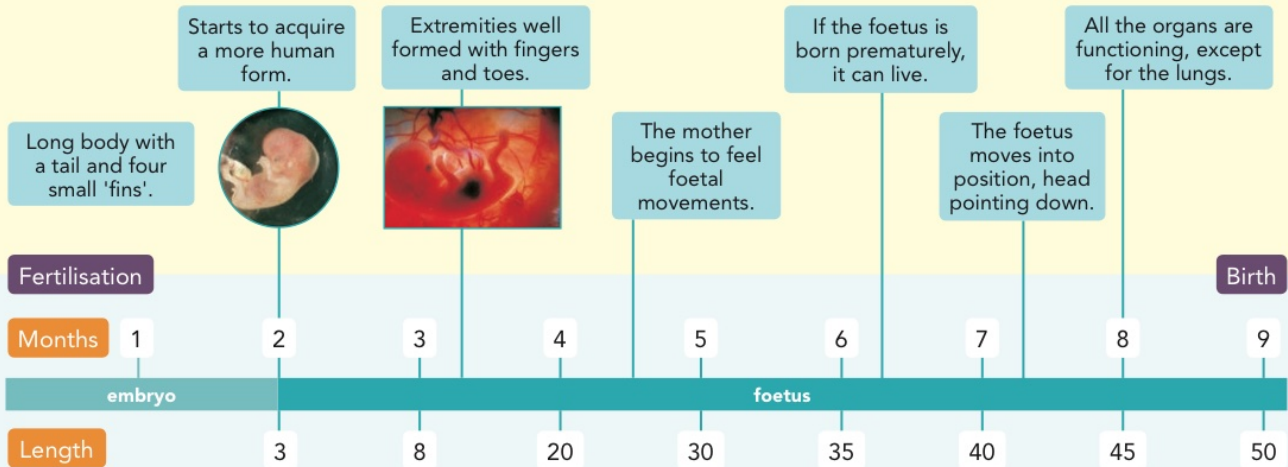


17. When can you hear an embryo's heartbeat for the first time?
18. How big is an embryo at the end of the embryonic stage?
19. When does the foetal stage begin and end?
20. Use the Internet to find out when the nervous system and eyes are formed.

21. Look online for the word 'viable' and answer these questions:
 - a) When is a foetus viable and can live outside of its mother's body?
 - b) What features can you observe in the ultrasound at 12 weeks? What features are visible at 8 weeks?

2 Analyse the changes in the foetus during pregnancy

Observe the chart showing the development of a human foetus during pregnancy and some important milestones that happen in each stage.



1. After looking at the chart, write in your notebook the number of months an embryo must be...

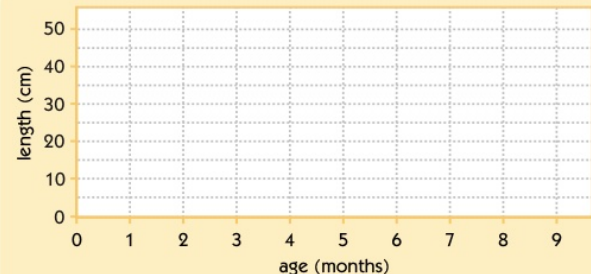
- to be able to live if it is born premature.
- for the mother to feel its movements.
- to begin to look more human.
- to move into the head-down position shortly before birth.

2. Make a graph in your notebook to chart the evolution of the embryo during pregnancy. Use the one on the right as an example.

- Look at the horizontal axis (months) and

the vertical axis (cm).

- Mark with a dot the length in cm of the embryo/foetus in each month of pregnancy.
- Connect the dots to see the growth.



Apply what you know

22. Look at your graph:

- How many centimetres has the embryo grown from day 1 to 3 months? And between 3 and 6 months? And from 6 to 9 months?
- When did it grow more quickly (in which months)? In which months did it grow more slowly?

23. Do some online research about the different types of imaging that exist to help us observe the foetus during pregnancy.

- What types of waves help us to form an image of the foetus?
- What animals use the same type of waves to form an impression of their surroundings?

How do we change from childhood to old age?

Human beings pass through different stages throughout their lives. Our development starts in **childhood** and **adolescence**, when **puberty** occurs. After that, we pass through **young adulthood**, **adulthood**, and finally we reach **old age**.

Find and define:

- adolescence
- puberty
- young adulthood
- childhood
- old age
- adulthood
- sexually transmitted diseases

The stages of life

Childhood

Until the age of 1 year old, a child is still a baby. During this time the baby grows very quickly. After a year, children grow at a slower rate, and their bones and muscle get stronger.

They get to know the world around them in this stage, and they learn how to walk.



Adolescence

This is the stage that takes place from about 10 years of age to 18 in girls, and 12 to 18 in boys. This is when the most important physical and psychological changes take place.



5

Old age

With the passing of time, the body loses its ability to repair itself and people begin to age. People may lose some physical capabilities, but they gain life experience.



Young adulthood

This stage starts at 18 years old. During this stage the body stops growing. A person's character and tastes become established, and their social life becomes important too.



Adulthood

In this stage the body has developed to its full potential and few changes take place. People feel the desire to form a family and have children to share their lives with.



- What are the five stages of life?
- What happens to the body at the beginning of young adulthood?

► Learn More: What is puberty?

Puberty is the period in adolescence that is characterised by the development of the secondary sexual characteristics and the ability to reproduce.

Everyone goes through puberty, but in a way and at a rhythm that is individual to the person. Many changes occur during adolescence:



Physical changes

One of the first signs of puberty in girls is the development of breasts and the beginning of menstruation. Boys begin to grow more hair and their voices change. A boy's testicles and penis grow, as well.



Social integration

Your social life acquires a new importance in adolescence. We know and learn to respect new rules and values.



New emotions

The bodily changes are accompanied by emotional changes. It is likely that unknown feelings appear: confusion, enthusiasm, doubt, anxiety, curiosity, anger and frustration, to name a few.

What are sexually transmitted infections (STIs)?

STIs are serious illnesses that are caused by bacteria, fungi, viruses, or parasites. These infections spread primarily through unprotected sexual contact. The most common are **AIDS**, hepatitis B, syphilis, gonorrhoea, genital herpes and human papilloma virus.

Using condoms during sexual contact and avoiding contact with an infected person's blood are the two main ways to protect yourself from STIs.

- © What are the first signs of puberty in boys and girls?

► Learn, apply and reason

24. How long does each stage of life last?
25. In which stage does a person learn how to walk and talk? What age were you?
26. Do boys or girls start puberty first?
27. What are the characteristics of adulthood?
28. **LS₂** Get into small groups and make a list of some of the changes, that boys and girls go through

during puberty. Have you noticed any of these changes or do you feel and look more or less the same as you did at this time last year? Talk about your experiences with your group.

29. **42** Listen to the man talking about an incident in his life. In what stage of life did the incident occur?

LS₃ Act out the stages of your life

We are going to write and perform a play to show the different stages of life that a human being experiences.

1 Assign each stage to a group

Your teacher will divide the class into five groups. Each group will be assigned a stage (childhood, adolescence (including puberty), young adulthood, adulthood, or old age) at random, and the members of each group will be assigned a role in the group.

Group structure: divide the class into 5 groups.

Functions or roles of group members:

Director

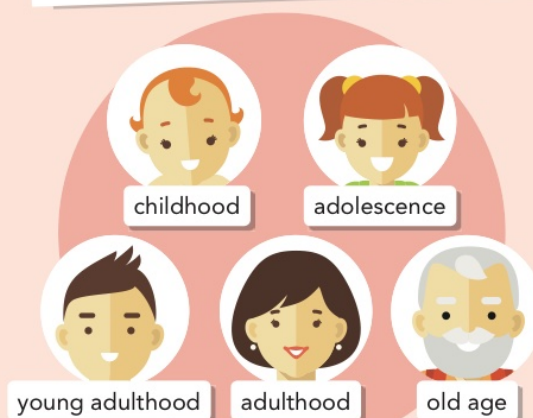
Actors

Technical team

Scriptwriter

Time: 2 class sessions.

Material: computer, clothes, makeup, and props.



2 Assign the specific jobs in each group

A play needs to have a **director**, **actors**, and a **technical team**. These can be assigned by the teacher or the group can decide who will perform each task.

The **director** directs the rehearsals (practice performances).



The **actors** (at least 2 people) act out the scene.

The **technical team** takes care of the clothing, the makeup and hair, the props, the sound, etc.



3 Look for information

The members of the group look for information and decide who the main characters will be. They should think about: what they are like, how they live, how they feel, and how they interact with their surroundings.

You can also observe people you know in the stage of life you have been assigned, and ask your family, friends and teachers for information.



4 Write your script and create your scene

Describe the situation you want to act out. Think about if you need dialogue and then write it. Think about anything that could help you act out your scene (for example, special clothes, or props).

The **scriptwriter**, collects all of the information on one computer document and then shares it with the group. The actors decide which parts to play.



5 Rehearse and prepare your scene

- The **director** should think about how the actors and actresses will move and act. They should memorise the script. During rehearsal, the director will give advice on how to make the play the best it can be.
- The **technical team** will organise the props and other objects that the play and the performers need. Some of these may be noted down in the script.
- The **teacher** will book the auditorium and make an announcement to the school about the play.



6 Showtime!

The technical team will prepare the stage and help the actors and actresses with their hair, makeup, and clothes.

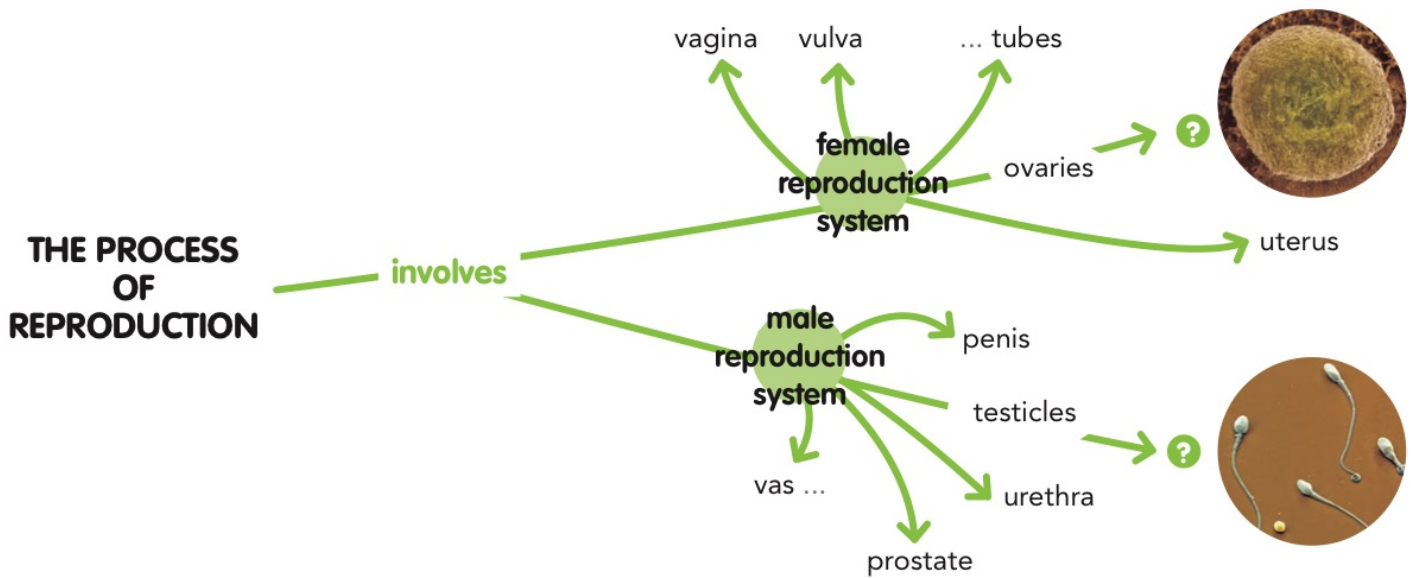
In chronological order from youngest to oldest, each group acts out its stage of life for the rest of the class.



Think and answer

- Did you have fun doing this activity?
- What was the play like (think about the acting, the scripts, the props)? Were the stages of life well performed? Were the main characteristics of each one represented and could you identify them?
- How do you feel about your work and the way your stage of life was performed?
- Were you happy with your stage of life or would you prefer to do another? Which one?
- Was it difficult to work in a team? Did people do their assigned jobs well?
- How could you improve (make better) this activity?

1. Copy the concept map into your notebook:



- a) In sexual reproduction, new life is formed when an ... and a ... join during
- b) The main organs of the male reproductive system are the... and the....
- c) The organs of the female reproductive system are the..., the vulva, the Fallopian tubes, the ... and the
- d) The zygote transforms into an Near the end of the second month, it is called a
- e) During ..., the new life lives in the uterus and receives food and expels waste through the This period ends when the mother gives birth.
- f) During ..., also known as a woman's period, the egg leaves the body together with a superficial layer of the lining of the
- g) The five main stages of life are ..., ..., young adulthood, ... and

2. In each of these sentences there is an incorrect word. Find it and change it so that the sentences are true. Write the new sentences in your notebook.

- a) The male reproductive system produces eggs.
- b) The penis, testicles, urethra, vagina and vas deferens are part the male reproductive system.
- c) The uterus, prostate, ovaries, Fallopian tubes and vagina are part of the female reproductive system.
- d) During birth, the zygote transforms into an embryo, which then becomes a foetus.
- e) Adolescence takes place between the ages of 18-25, approximately.



Remember, it is important to go to the Gym to do some exercises.



1. The following questions contain a verb that is either in the wrong tense or has the wrong conjugation. Correct the mistake and take it in turns to ask and answer the questions with a partner:

- What is the secondary sexual characteristics of men?
- How long are the normal reproductive cycle of a woman?
- How many eggs does the ovaries of a woman release each month?
- What is happening to a woman's period during pregnancy?
- In which part of a woman's reproductive system does fertilisation occurred?
- When does an embryo became a foetus?
- When does adolescence normally ends for boys and girls?
- What physical changes occurred in boys and girls during puberty?

2. Match the words to the definitions. Then, use them in sentences to talk about the physical and emotional changes you may have noticed. A few example sentences have been done for you. These will help with activity 28 on page 61.

- period
- doubt
- angry
- anxious
- confused
- social life

- a feeling of uncertainty
- feeling worried and apprehensive
- not clear about what is happening
- another word for menstruation
- feeling hostility and annoyance
- leisure time spent with friends



- I (have/haven't) started my period.
- I (have/haven't) noticed feelings of doubt.
- (I am/I'm not) starting to feel (anxious) about things.

3. Perform a play about the different stages of life. Use the sentences below to help you with the activity on pages 62-63.



4

Looking after your health

Objectives

We are going to learn about:

- the difference between good and bad health, and the main types of diseases.
- healthy lifestyles.
- different types of foods and how to recognise a balanced diet.
- toxic substances and how they affect our health.
- first aid techniques and how to prevent accidents at home.
- the sugar content of drinks.
- food labels and what they mean.

44 Useful language

- You can keep your body healthy by (doing exercise).
- (Smoking) causes (lung cancer).
- People who die young (sometimes have unhealthy lifestyles).

43 A very healthy sneeze

The Troll family were looking for a magic spell to make themselves look beautiful.

But Little Troll sneezed and dropped the book of magic spells and the letters got mixed up.

"Oh no! It's turned into a recipe book!", said Father Troll.

"How are we going to find a spell to make ourselves beautiful now?" "I don't know", said Little Troll, "but I like these new recipes. I'm going to follow them and make some lovely food".

One day, a brave knight in shining armour appeared at the Troll family's house. When he saw Little Troll with her parents, he shouted, "Do not fear, princess! I'll rescue you from those horrible trolls!"

As Little Troll looked at the knight, she saw her reflection in his armour. There were no mirrors in the Troll family house and she was curious. She could not believe what she saw. She looked just like a normal girl!

The mystery was quickly solved. They discovered that none of them were trolls, but they ate so few fruits and vegetables that they could not see properly and their wounds did not heal. That was why they looked so terrible! And, of course, when Little Troll started to cook and eat the recipes in the book, she looked wonderful!

Pedro Pablo SACRISTÁN: *Un estornudo muy sano* (translated and adapted). cuentosparadormir.com, 2019.

1. What did the Troll family look like before their spell book turned into a recipe book?
2. What were the consequences of not eating fruit and vegetables for the family who thought they were trolls?

Do you know?

- Do you know how to avoid catching an infectious disease?
- Would you like to know what you should eat every day and what exercise you should do?

Reflect

- Some people live to be a hundred, but others die young because of diseases. What are the reasons for these differences?

Think

- What can you do to keep your body healthy?
- What are the effects of harmful habits, such as drinking alcohol, smoking and taking drugs?

Health and illness

Health is not just an absence of disease; it is a state of physical, mental and social wellbeing. A **disease** is a condition that affects health.

We are considered to be ill when we have symptoms such as coughing, fever, nausea or pain, and also if we suffer from a mental disorder or a **lack** of social integration.

| 🗣️ What is health?

What are the main types of disease?

The most common diseases are classified as **infectious** and **non-infectious**.

Infectious diseases

These are diseases caused by viruses, bacteria, fungi and parasites that enter the body through the nose, mouth or wounds. They can cause fever and general illness.

Diseases caused by **viruses** include flu, measles, rubella, chickenpox, mumps and AIDS.

The main diseases caused by bacteria are tuberculosis, tonsillitis, pharyngitis, whooping cough, bronchitis and pneumonia. Unlike viral diseases, bacterial diseases can be treated with antibiotics.

Non-infectious diseases

These are diseases that are not caused by microorganisms. Some of the most common are genetic disorders, cancer, degenerative diseases, nutritional deficiencies and environmental diseases:

- **Genetic disorders:** these are due to alterations in the genes of a person's cells (in other words, in the DNA of the cell nucleus).
- **Cancer:** this is due to genetic changes that cause the cells to multiply uncontrollably. Genetic modifications may be caused by environmental pollutants, radiation or natural alterations in the DNA.
- **Degenerative diseases:** these are caused by chronic cell changes that get worse over time.
- **Nutritional deficiencies:** these are caused by a lack of nutrients or the inability to absorb nutrients properly.

| 🗣️ What is a non-infectious diseases?



Physical exercise, social relationships and mental balance are essential for good health.

Environmental diseases

These are illnesses caused by **environmental pollution**.

They are becoming more common due to all the pollutants in the air, water, food and even materials used in kitchen utensils, construction and clothing.



Vocabulary

lack: deficiency

► Learn more: How are infectious diseases spread?



Health

Infectious diseases can be transmitted through contact with an ill person, through a wound or insect bite, by drinking unclean water or by eating food that has expired or gone bad.

How to avoid infectious diseases

Wash fruit and vegetables before eating them, **do not** eat food that is out of date and **do not** drink dirty water.

Wash your hands properly before eating, after going to the toilet and after blowing your nose.



Disinfect wounds with the help of an adult.

Do not walk barefoot around swimming pools or in changing rooms. Fungal diseases spread easily.

The importance of vaccines

Vaccines are used to prevent the most serious **infectious** diseases. That is why it is so important to have all compulsory vaccines.

In addition to protecting us, they also ensure that we do not infect others and cause them to have serious complications, which can result from diseases such as polio, measles and chickenpox.

Scientific advances and quality of life

There have been improvements in people's quality of life thanks to vaccines, antibiotics and other advances related to early diagnosis, surgery and organ transplants.

Some scientists who have contributed to these advances are **Edward Jenner**, who discovered the first vaccine (smallpox), and **Alexander Fleming**, who discovered the antibiotic penicillin.

Recent medical advances have mostly been due to knowledge of **genetic material (DNA)** which is used to prevent diseases and create much more effective medicines.



► Learn, apply and reason

1. Decide if the following are infectious or non-infectious diseases: cancer - AIDS - diabetes - Alzheimers - measles - chickenpox. Which ones are caused by a virus?
2. Should you take antibiotics to treat flu? Give reasons for your answer.
3. Do you know what anaesthetics are used for in

modern medicine? Use the Internet to find out if necessary.

4. Look up the vaccination schedule on the Internet and check that you have had them all.
5. **LS1** What could happen to your classmates if a student was not vaccinated? Have a debate about this important issue.

a healthy lifestyle

The main features of a **healthy lifestyle** are a balanced diet, exercise, good personal hygiene, mental balance and a respectful relationship with others.

Find and define:

- lifestyle
- mental balance
- identity
- autonomy
- empathy
- self-esteem

Recommendations for a healthy lifestyle

A balanced diet

A diet that includes all foods in the correct proportions and in sufficient quantities to fulfil the body's needs.

Medical check-ups

It is important to have all compulsory vaccinations, go to the dentist and see your GP when you have the symptoms of a disease.

Avoid toxic substances

For good health, it is very important to avoid smoking, drinking alcohol and taking drugs and to avoid polluted areas.

Social relationships

These are fundamental for good health. Social isolation can harm a person's physical and mental health.

Physical exercise

This helps burn calories, strengthen muscles and bones, and reduce blood pressure, cholesterol and blood sugar.

Good personal hygiene

This helps prevent many health problems, including infections and dental and skin problems.



❶ Why is it important to practise good personal hygiene?

What are the consequences of overusing mobile phones and social networks?

Numerous scientific studies show that there has been a rise in psychological problems, such as depression and anxiety, caused by overusing social networks, mobile phones and other electronic devices, including computers and tablets.

In addition, addiction to social networks can often lead to cyberbullying.

Spending hours in front of screens can also cause

physical problems, such as vision problems, neck and joint pain, and even obesity due to a lack of physical exercise.

Therefore, these electronic devices should be used in moderation and always under adult supervision.

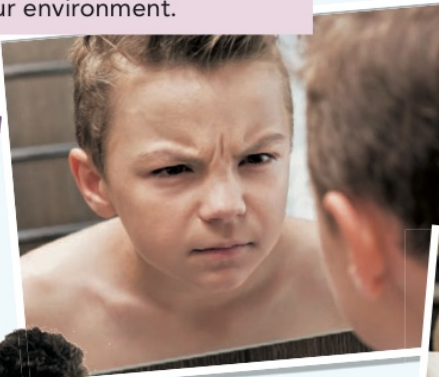
❷ What are some of the problems associated with using electronic devices?

Mental balance and health

As you grow into adults, the **traits** that help you mature and achieve **mental balance** are **identity**, **autonomy**, **self-esteem** and **empathy**.

Identity

This is the ability to know yourself better and adapt to your environment.



Autonomy

This is the capacity to do things without help from others. It helps you improve your self-esteem and makes you more responsible.



Empathy

This is the capacity to understand other people's emotions and behaviour. It is important to listen carefully and try to understand others' opinions.



Self-esteem

This means having a positive opinion of yourself. It helps you achieve your goals and live a happier life.

- c Why is it important to have high self-esteem?

Vocabulary

traits: characteristics

Learn and explain

6. Out of all the healthy lifestyle habits recommended on page 70:
 - which ones do you think are the most important for your age group?
 - which habits do you usually practise?
7. Does your family talk about the need for healthy habits at home? Explain this to the class.
8. Do you have a mobile phone? Do you think you need one? Give reasons for your answer.
9. How would you rate your self-esteem and personal autonomy? Why do you think these traits are important?
10. If there are children of different races or religions at your school, do the other students treat them with respect? What can you do if you see someone treating them badly?

47 a balanced diet

Healthy eating is based on a **balanced diet**, one that includes the right amount of essential foods every day:

- You should consume the following every day: cereals and cereal products (e.g. bread and pasta), potatoes, fruit and vegetables, milk and milk products (such as cheese and yoghurt) and olive oil.
- You should consume legumes, nuts, fish, eggs and low-fat meats several times a week.
- You should only consume fatty meats, sausages, cakes and pastries, other sweet foods and sugary drinks occasionally.

The **food pyramid** is a diagram that shows how often different foods should be consumed and includes other health tips.

1 a What is a balanced diet?



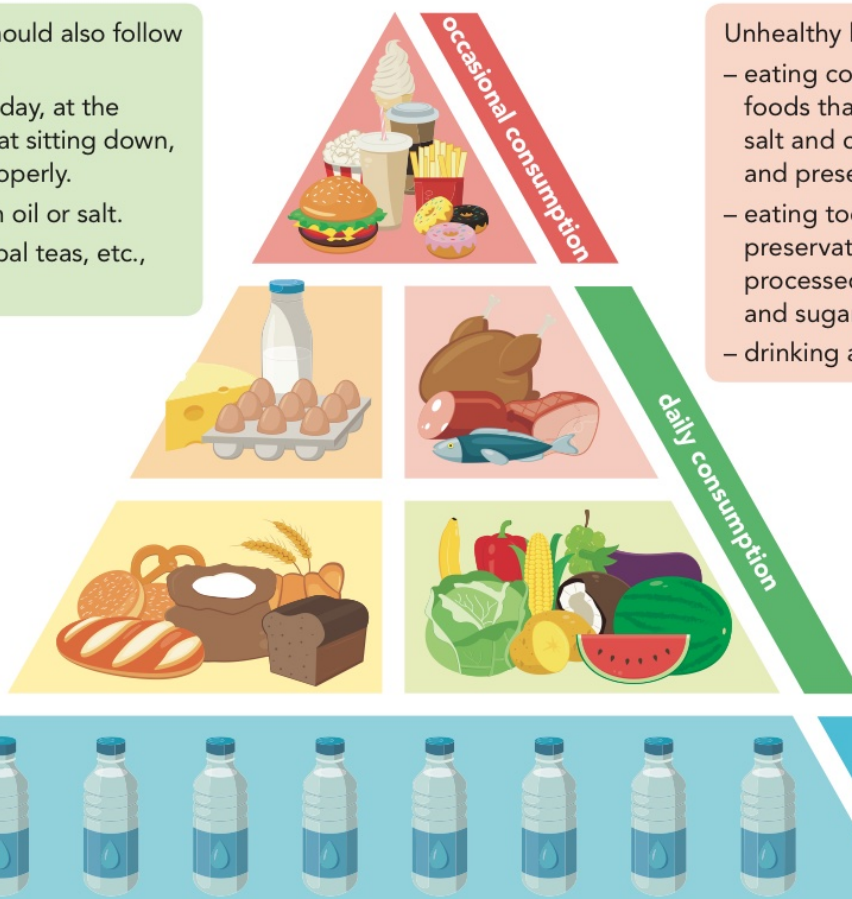
Online detectives

11. Choose a food from each of the categories in the food pyramid, and find out:
- its composition, properties and the calories it provides.
 - Compare the recommended number of servings per week with how much you consume.

The food pyramid

For a healthy diet, you should also follow these recommendations:

- Eat four or five times a day, at the same time every day. Eat sitting down, eat slowly and chew properly.
- Cook without too much oil or salt.
- Drink lots of water, herbal teas, etc., throughout the day.



Unhealthy habits include:

- eating convenience foods that are high in salt and contain colours and preservatives.
- eating too many preservatives, processed products and sugary drinks.
- drinking alcohol.



Foods and their functions

Different foods have different functions. Usually, each food type has more than one function. For example, hazelnuts provide the body with vitamins and minerals, but also energy.

Classification of foods according to their functions



Foods that provide you with the **energy** you need are bread, potatoes, pasta, legumes, nuts, olive oil and butter.



Foods that **repair** cellular damage or make new cells are meat, fish, eggs, milk and, to a lesser degree, legumes.



Foods that provide you with lots of **vitamins and minerals** (essential substances) are fruit, vegetables and, most of all, nuts.

Childhood obesity

Excess weight and obesity are caused by an excessive accumulation of fat in the body.

Spain has one of the highest childhood obesity levels in Europe. It is a serious health problem.

Obese children have a higher chance of developing diseases in adulthood, such as high cholesterol, high blood pressure and diabetes.

Sometimes, these diseases can start in childhood.

To avoid obesity, it is not enough to have a balanced diet. It is also important to exercise every day and lead an active life by walking a lot, climbing stairs and going hiking in the countryside.

- c** What problems can childhood obesity lead to?

- b** What do nuts provide the body with?

Learn and explain

12. Which foods do the following: make new cells - provide vitamins and minerals - provide energy. Listen and check.
13. Fat cells grow more quickly in childhood than in adulthood. Look for information on why childhood obesity can lead to serious health problems in adulthood.
14. Make a list of the foods that you ate for each meal yesterday: breakfast, morning snack, lunch, afternoon snack and dinner.
 - Indicate where in the pyramid each of the foods on your list appears.
 - Do you think you ate a balanced diet yesterday?

the damage caused by toxic substances

Toxic substances have harmful effects on people's health. These effects can be mild, such as headaches and nausea, or serious, such as convulsions, nervous system damage and even death.

The most common toxic substances are drugs, environmental pollutants and some products used in agriculture and cleaning.

What are drugs?

Drugs are chemical substances that can cause physical health problems and mental **impairment**.

Some drugs, such as **tobacco** and **alcohol**, are legal, while others, such as marijuana, amphetamines, cocaine and heroin, are illegal.

Drugs can also affect relationships with family and friends and can lead people to commit violence against others.

- What are the most common toxic substances?

Tobacco

Tobacco contains harmful substances, including nicotine and tar. **Nicotine** is addictive, which means the body becomes used to it and smokers feel ill when they do not have it.

Tobacco smoke also harms passive smokers, that is, the people around the smoker.

Tobacco smoke contains more than 70 substances that are known to cause cancer, including tar.

Other ingredients cause heart and lung diseases, infertility and other serious health problems.



In addition to causing direct deaths, pesticides have also been linked to cancer, nervous system diseases, hormonal disorders, developmental disorders and sterility.

Vocabulary

impairment: deterioration

Alcohol

Excessive alcohol consumption increases the risk of suffering from stomach, liver, heart and kidney diseases, high blood pressure and psychological problems, as it damages the neurons. That is why people under the age of 18 are not allowed to drink alcohol.

Alcohol consumption also causes many road accidents and violent incidents in families.

Type of drink	Volume	No. of units in a standard drink
Wine	1 x 100 ml glass	1 = 10 g
	1 L	10 = 100 g
Beer	1 x 200 ml glass	1 = 10 g
	1 L	5 = 50 g

Excessive alcohol consumption is defined as:

- more than 1 standard drink a day, equivalent to 10 g of pure alcohol, for women of all ages and men over 65 years of age.
- more than 2 standard drinks a day, equivalent to 20 g of pure alcohol, for men between 18 and 65 years of age.

Toxic substances in the environment

Many **chemicals** that pollute the air, water and soil are very damaging to living things.

For example, the plastics used to make many everyday objects are carried by water into rivers and oceans, where they cause serious harm to fish and other aquatic life.

Other polluting substances are the toxic gases emitted by vehicles and factories into the air we breathe. These can cause respiratory diseases and allergies.

The products used in agriculture to make plants grow better and food additives can also cause diseases. These diseases can result in different types of cancer.

- b** How does pollution from vehicles and factories harm us?

Air, water and soil pollution is one of the main problems faced by humanity. To make sure that it does not get worse, it is essential that we change our current lifestyle and consumption habits.



In addition to polluting the environment, plastic also contains many toxic substances that end up being consumed by human beings through the fish we eat.

Learn and explain

15. Listen to the descriptions of some different toxic substances and guess what they are.
16. Which drugs are legal? Why is alcohol so dangerous?
17. Name one illegal drug you have heard about, and the consequences of consuming it.
18. What serious diseases are caused by tobacco? Did you know that the people who live with smokers can also get these diseases, even if they do not smoke? What are these people called?
19. Do you recycle plastic products or do you throw them in the bin? How does using these products affect marine life?
20. Do you live in a city with a lot of pollution or in a town or village? Discuss the following questions in class:
 - a) How do you think pollution affects people?
 - b) What are the health benefits of living in a small town or the countryside?
21. If a 10 ml glass of brandy is equivalent to 2 standard drinks, how many grams of pure alcohol does it contain?
22. How does excessive alcohol consumption affect people's health?

What are the benefits of physical exercise?

Today's sedentary lifestyle, with means of transport that allow people to move around without walking, long school hours and office-based jobs that involve sitting for hours in front of a computer, is very unhealthy.

The popularity of activities that involve sitting down, such as playing on electronic devices, also means that people exercise outdoors less often.

❶ Why are people less active now than in the past?



The time you spend playing on electronic devices should be restricted to an hour a day and should always be supervised by an adult.

Benefits of physical exercise

Improves learning, concentration and memory skills.

Reduces stress and anxiety and improves self-esteem.

Encourages social relationships and teamwork.

Relieves the symptoms of dementia, Parkinson's disease and multiple sclerosis.

Lowers cholesterol and blood sugar levels (diabetes).

Prevents and improves heart and respiratory diseases.

Helps control obesity and high blood pressure.

Prevents and improves muscle- and bone-related health problems.

► **Learn more:** What are the exercise recommendations according to age?

According to the World Health Organisation (WHO), a lack of physical exercise is the fourth leading cause of death in the world, since it is responsible for more than three million deaths a year.

It claims that 23 % of adults and 81 % of young people do not get enough physical exercise.

- b** How many people die every year from a lack of physical exercise?

What is aerobic exercise?

This is moderate or low-effort exercise during which the body obtains energy through a process of cellular respiration that uses oxygen from the air. Examples of aerobic exercise are running, swimming, cycling and walking.

Physical exercise recommendations by age



Children and young people between 5 and 17 years of age should do at least 60 minutes of moderate- to vigorous-intensity physical activity every day.



Adults should do at least 150 minutes of moderate-intensity aerobic activity throughout the week or at least 75 minutes of vigorous-intensity activity.



Adults over 65 years of age, especially those with poor mobility, should perform physical activity to strengthen their muscles and improve their balance, at least three days a week.

► **Learn, apply and reason**

23. Did you know about the benefits of doing physical exercise every day? Which of these benefits are the most important at your age?

24. LS₂ How many minutes do you spend doing physical exercise every day? Conduct a short survey in class about the time your classmates spend exercising, and calculate the average.

Check whether this average is similar to the recommendations mentioned on this page.

25. Do your parents and grandparents do any aerobic exercise? How do you think exercise benefits them? Do you regularly do any sports with your family?

first aid techniques

Sometimes people around us **faint**, suffer bleeding or get injured. To help them, it is important to learn simple techniques that could help save lives.

We use **first aid techniques** to care for someone who has fainted or suffered an injury. The main goal is to ensure that the person's condition does not get any worse.

Some of these techniques, such as cleaning wounds, are easy. Others, such as dealing with someone who has fainted, require more knowledge.

In serious situations, it is necessary to call the emergency services.

❶ What is the main goal of first aid?

Find and define:

- first aid techniques
- fainting
- nosebleed
- wound
- burn



To carry out first aid techniques correctly, it is very important to know what we **SHOULD** do and also what we **SHOULD NOT** do.

What to do when someone has fainted

Fainting or temporary loss of consciousness is due to insufficient blood flow to the brain or heart failure.

If you feel faint, lie down, or sit down with your head between your knees.

If someone else faints, do the following:

- Position the person on their back.
- If the person is breathing, raise their legs and loosen belts, collars and other constrictive clothing.
- If the person is nauseous or vomits, turn their head to one side to prevent choking.



❷ What should you do if you feel faint?

Treating a nosebleed



The nose contains a large number of tiny blood vessels that bleed easily. Although most nosebleeds are superficial, some occur deep inside the nose.

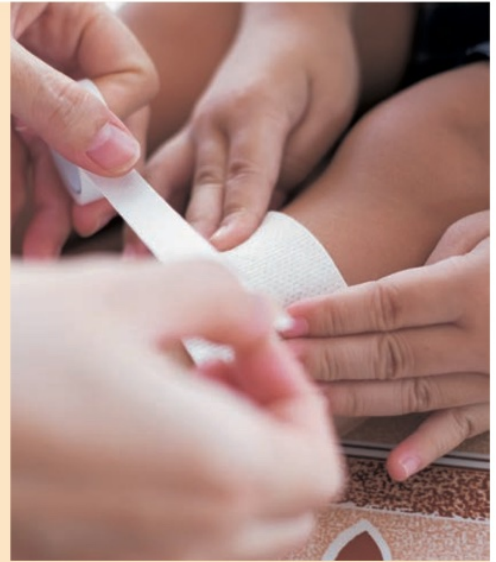
To stop a **nosebleed**, lean the person forward to prevent them from swallowing blood, then press the nostrils together for 5 to 10 minutes.

Treating a wound

Wounds occur when the skin is broken. To prevent infection, it is important to treat them quickly:

- Wash the wound with soap and water, without rubbing it. Use gauze (never cotton wool). If the wound is not bleeding, leave it uncovered.
- Do not use alcohol, which is an irritant. Apply an antiseptic solution moving from the centre to the outside.
- If there is any debris on the surface of the wound, remove it with disinfected tweezers.
- To treat a bleeding wound, cover it with gauze to prevent infection until a scab forms.

c Why should you not use alcohol to treat a wound?



Treating a burn

Depending on how many skin layers are affected, burns can be mild (superficial) or serious (deep).

Wash a **mild burn** with cold water, without touching it, and cover it with ointment and sterile gauze.

If there are **blisters**, do not break them or apply ointment.

In very **serious burns**, lay the victim down and cut off any clothing that is not stuck to the skin, while you wait for medical help to arrive.



Sunburn can be very dangerous and can even cause skin cancer. For that reason, it is important not to spend too much time in the sun and always use sunscreen.

d How should you treat a mild burn?

Vocabulary

faint: lose consciousness

blisters: bubbles filled with liquid on the skin

Learn and explain

26. What are first aid techniques? Why do you think it is important for everyone to learn them?
27. Have any of your friends fainted? If so, how did you help them? Did you know what to do?
28. How should you treat a nosebleed? Look at the advice on the previous page and describe the steps.
29. Why should wounds not be cleaned from the outside towards the centre? What is the first step in treating a wound?
30. What should you use to prevent a wound getting infected?
31. What are the consequences of spending too much time in the sun or not using sunscreen?

domestic accidents and how to prevent them

Domestic accidents are those that occur in the home. The most common are falls, burns, cuts, choking, electric shocks and poisoning.

The people who are most at risk of having these accidents are children and elderly people.

|  What are the most common domestic accidents?

Find and define:

- domestic accident
- food poisoning
- Heimlich manoeuvre

Measures to prevent domestic accidents



Keep floors dry and put anti-slip mats in showers and baths, and under rugs.

Turn the gas off and never leave cooking food unattended. Keep hot pans **out of reach** of children and elderly people.



Install stair guards and handrails and walk up and down stairs carefully.



Do not leave stoves or fires on if they are not constantly monitored.



Do not eat food that has expired or gone bad.

Do not use electrical devices with wet hands or in the bathroom.



Keep medicines and toxic substances, such as cleaning products and disinfectants, paint and gardening products, out of reach of children and elderly people.



Do not repair sockets or electric cables without turning off the mains switch.



Chew slowly and do not talk or laugh while eating or drinking.

Keep knives and other sharp objects out of reach of children, and use them carefully.



What is food poisoning?

Food poisoning is an infection caused by eating food contaminated by bacteria, viruses or parasites, or substances produced by them, called toxins.

Foods can be contaminated if they are stored at the incorrect temperature or handled or cooked incorrectly.

The symptoms of food poisoning are vomiting and diarrhoea and can begin a few hours after eating contaminated foods. They are usually mild.

In the most serious cases, the affected person should go to hospital to avoid dehydration (excessive fluid loss).

The most vulnerable people are the elderly, pregnant women, babies and young children.



To avoid food poisoning, do not eat eggs that float, meat that has changed colour, fish with cloudy eyes and dull-coloured gills, vegetables and fruit that have not been washed and food that has not been refrigerated properly.

| **b** What is food poisoning?

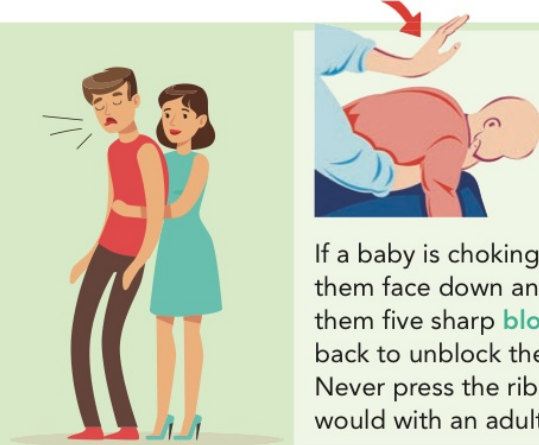
What is choking?

Choking occurs when the airways become blocked by food or another object.

If someone is choking, perform the **Heimlich manoeuvre**: stand behind the person who is choking, wrap your arms around their waist and bend them forward. Place a **fist** between their belly button and the lowest part of their ribs, and press hard.

Repeat the manoeuvre until the object or food is dislodged.

If you are alone and start choking, press your upper abdomen against the edge of a table, chair or railing, and push hard.



If a baby is choking, place them face down and give them five sharp **blows** on the back to unblock the airways. Never press the ribs, as you would with an adult.

| **c** How do you perform the Heimlich manoeuvre?

Vocabulary

out of reach: not near enough to touch

fist: hand closed tightly

blows: hits; strikes

► Learn and explain

32. Copy and complete the table in your notebook:

Type of accident	How to prevent it
...	...

33. What groups of people need to be extra careful to avoid domestic accidents? List three precautions to help keep these groups of people safe.

34. What accidents can occur with sockets or electric cables, especially if there are children in the home? What are the possible consequences of an accident like this?

35. What is food poisoning and how can you avoid it?

36. What type of organisms cause food poisoning?

check the sugar content of drinks

According to WHO, sugar consumption in Spain is among the highest in Europe, since it represents 16% of our daily energy intake. The organisation recommends limiting sugar intake to 5%.

Find out more about some foods and drinks that are surprisingly high in sugar at:

www.tiching.com/776967



Learning how to check sugar content

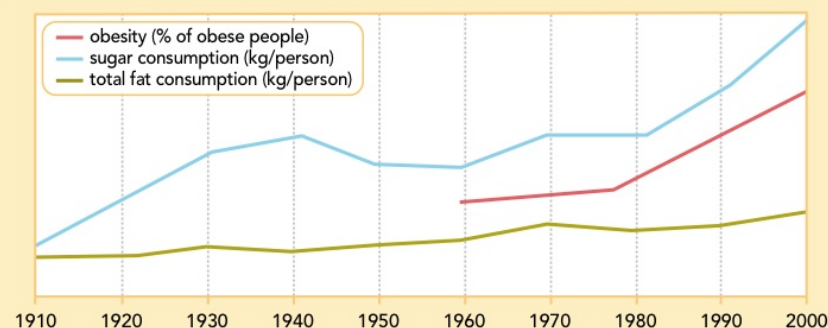
1 Why is too much sugar harmful?

In the last few decades, the intake of fat, especially animal fats, has been linked to many diseases, including high cholesterol and obesity.

However, a high sugar intake is also directly associated with diseases such as cardiovascular disease, diabetes and obesity, as well as tooth decay.

- a Why is too much sugar harmful?

Relationship between obesity and the consumption of sugar and fat



This graph shows how obesity is associated just as much (or more so) with sugar intake as with fat intake.

2 Where does the sugar in our diet come from?

In addition to the sugar added to coffee and found in sweet foods, especially cakes and pastries, many foods have a high sugar content.

Foods containing sugar that often go unnoticed include processed foods such as sauces and yoghurts, sugary drinks and alcohol.

Food	Sugary drink	Plain biscuits	Tomato sauce	Fat-free yoghurt	Breakfast cereals	Pineapple juice from a carton	Strawberry jam	Cocoa powder
Quantity	1 can	6 biscuits	3 tablespoons	1 yoghurt	35 grams	1 glass	1 tablespoon	1 tablespoon
Sugar spoons (4 g)	x9	x2	x1	x2	x2	x5.5	x1.8	x3.5

3 How do I check the sugar content of a food?

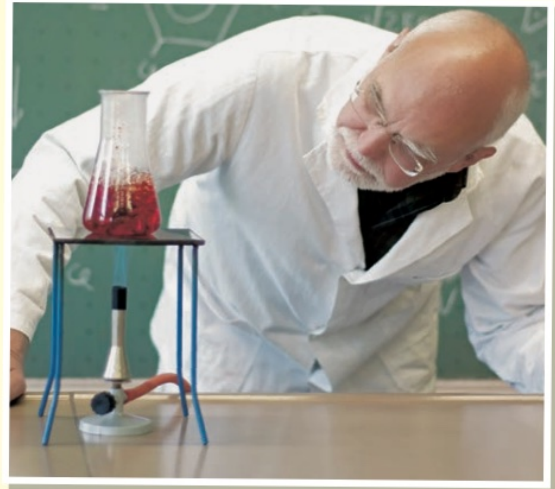
To check the approximate sugar content of various drinks, work in groups of three or four pupils.

Follow these steps, with the help of the teacher:

1. Weigh the measuring beakers and make a note of the weight of each one. Then, pour the contents of a can of cola, an energy drink and a carton of orange juice into the beakers.
2. Weigh the three beakers again and write down the data.
3. Place the beakers on a stove (preferably electric) and heat them until they reach boiling point. This step should be carried out with the teacher's supervision to prevent burns.
4. Let the beakers boil until all the water has evaporated and only a sticky substance is left. This substance is the sugar content.
5. Using heatproof gloves, remove the beakers from the stove and weigh them again.
6. Lastly, subtract the weight of the empty beakers from the final weight and write down the new data in your notebook.

Materials

- 3 sugary drinks (cola, orange juice and an energy drink)
- measuring beakers
- electric stove
- heatproof gloves
- scales



Boiling a sugary drink in the laboratory to remove the water.

Vocabulary

intake: consumption

decay: damage

Apply what you know

37. How can you calculate the approximate sugar content of the drinks using the data obtained?
38. Check whether the sugar content indicated on each drink label matches your results. What could have caused any differences?
39. Bearing in mind that girls aged between 11 and 14 years need approximately 2200 kcal/day and boys of the same age need approximately 2750 kcal/day, calculate the maximum amount of sugar you should consume per day if you are following WHO guidelines (1 g sugar provides 4 kcal).
40. If you drink a glass of cola, a glass of orange juice and a glass of energy drink on a hot summer's day, how much sugar will you have consumed?
41. How can a high sugar intake affect your health? How can you avoid the negative consequences?

Interpreting food labels

In this activity, you will analyse the labels on packaged products to check that they provide the information required by law. You will then use the data to debate in groups.

1

Organise work groups

The teacher divides the class into groups and assigns a different food label to each one. For example, one group analyses a margarine label, one a biscuit label, one a sausage label, one a tinned food label, etc.

Group structure: groups of 4 pupils.

Functions or roles of group members:

Coordinator: receives instructions from the teacher and manages time.

Speaker: shares information with the group.

Secretary: is responsible for the group's written tasks.

Time: 45 minutes.

Material: calculator, marker pens and different food labels.

2

Interpret a label

The information on labels is often difficult to interpret. To make it easier, some European countries use **traffic light systems**:

Find out more about the traffic light system for food labels at:

www.tiching.com/776968



One of these systems indicates the number of calories, total fat, saturated fat, sugars and salt in one serving, using colours: green for healthy, red for unhealthy and amber for medium.

Each portion (15 g) contains:



Per 100 g	CALORIES (kcal)	SUGAR (g)	FAT (g)	SATURATED FAT	SALT (g)
LOW	150 or less	6.75 or less	5.25 or less	1.50 or less	0.45 or less
MED	150 - 400	6.75 - 18	5.25 - 14	1.50 - 4	0.45 - 1.20
HIGH	400 or more	18 or more	14 or more	4 or more	1.20 or more

Another system, called the Nutri-score, consists of five coloured letters from green to red (healthiest to least healthy). Spain will introduce this system in the near future.



3

Analyse the labels from different foods

First, analyse these two actual labels from packaged orange juice and hot dog sausages:

- Which label corresponds to the juice and which to the sausages? How did you identify them?
- Using coloured marker pens, mark the calories, total fat, etc. on these two labels in green, yellow or red, according to the criteria of the traffic light system.

Then, check whether the labels from margarine, biscuits and tinned food in your home use the traffic light system. If not, use your marker pens to add colours to the nutritional information on their labels.

Nutritional information per 100 g	
Energy (kcal)	116
Proteins (g)	5.1
Total fats (g)	8.5
of which:	
Saturated fats (g)	2.8
Carbohydrates	4.7
of which:	
Sugars (g)	0.5
Salt (g)	0.9
Phosphorus (mg)	49.3

NUTRITIONAL INFORMATION PER 100 ML (average values)	
ENERGY VALUE:	47 kcal
PROTEINS:	0.0 g
CARBOHYDRATES	11.2 g
OF WHICH, SUGARS:	11.2 g
FAT:	0.0 g
OF WHICH, SATURATED FATTY ACIDS:	0.0 g
FOOD FIBRE:	0.0 g
SODIUM:	0.0 g

Nutrients	Daily requirements
Protein	60-70 g
Carbohydrate	270-315 g
Fat	60-70 g
Cholesterol	200 mg
Fibre	30 g

Finally, for a person who needs between 1500 and 1750 kcal:

- calculate how many kilocalories they would get from 100 g of sausages and 100 ml of orange juice.
- According to the table on the left, would they have consumed the amount of carbohydrate and protein they need in a day?

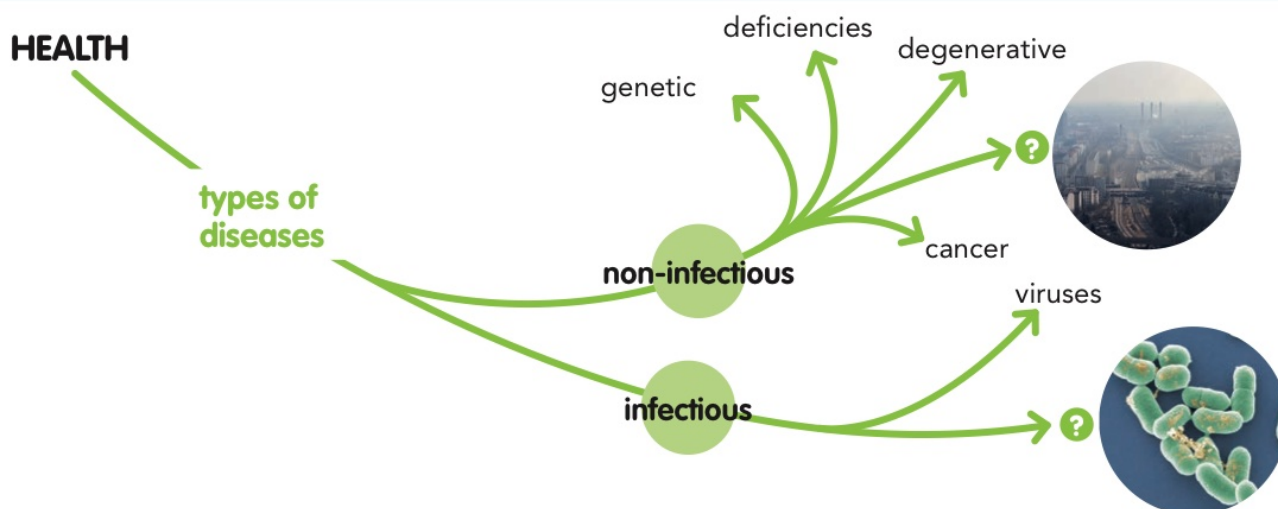
Think and answer

- Did all the labels feature the colours of the traffic light system? Were the labels with colours easier to interpret?
- Did the food labels you analysed contain use by or best before dates? Do you think this information is important? Why?
- Do you know why labels have to show the amount of saturated fat, in addition to total

fat? Do you think this is because saturated fat is unhealthy?

- Which of the foods you analysed contained the most saturated fat? Do you think it is a good idea to eat this food often?
- Have a short debate in class about food labels and present your results.

1. Copy and complete in your notebook:



- Health is not just an absence of disease; it is a state of ..., mental and ... wellbeing.
- The most common infectious diseases are caused by ... and
- The main toxic substances that affect health are ..., ... and illegal drugs.
- ... help prevent the most serious infectious diseases.
- Antibiotics should only be used if the disease is caused by
- ... techniques are used to ensure that an injury does not get any worse while you are waiting for medical help to arrive.

2. Write a report about organ transplants by following these steps:

- Divide the class into four groups, each of which will research a different organ: kidney, heart, liver and pancreas.
- Look for information on each type of organ transplant in books, newspapers, etc. Use an Internet search engine to look up the terms 'organ transplants', 'kidney transplant', etc. on specialised websites. Try to ensure that they are official organisations.
- Once you have selected the information, draw the most important conclusions and write a report. Then create a wall display featuring a summary of the most relevant information on each type of organ transplant.
- Choose a representative from each group to read out the summary.
- To finish off, contact someone who has had an organ transplant and ask them about their experience. Then have a group discussion about the importance of transplants and highlight what you found most interesting.

Remember, it is important to go to the Gym to do some exercises.



1. Copy and complete the table with the expressions in the box. Then, use them to help you do activity 5 on page 69:

Stating an opinion	Agreeing	Disagreeing
...	...	...

I completely disagree.

Absolutely!

Exactly!

I see your point but...

I think...

Absolutely not!

In my opinion...

My position is...

That's a very good point.

I agree!

2. Put the questions in the correct order. Then, use them in activity 24 on page 77:
- times a week / How many / after school? / do you do a sport
 - do you ride / How often / a bike?
 - Do you / every week? / go swimming
 - do every day? / minutes of exercise / How many / do you
 - or low-effort / Which moderate- / do you do? / types of exercise
 - you do? / activities do / Which vigorous-intensity



3. Copy and complete the conversation with the missing phrases. Then, act it out in pairs:

Patient: Hello Doctor. I feel very tired and I don't have any energy

Doctor: Hmmm. Let's see. What do you eat in a typical day?

Patient: ... And sometimes I have some meat or fish.

Doctor: Oh dear! You should What about exercise?

Patient: ... But only in summer. It's too cold to swim in winter.

Doctor: I think you should ...

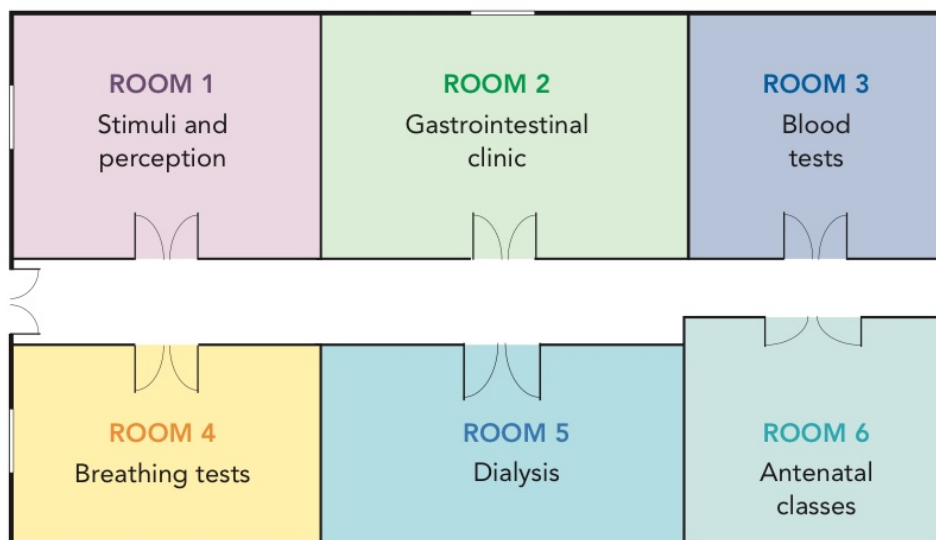
Patient: Thank you Doctor! ...

- eat a more balanced diet.
- do more exercise.
- What do you think is the matter?
- I like swimming!
- I will follow your advice.
- I eat a lot of crisps and sweets.

Practise your skills

1. Last week, a health centre opened its doors to the public so that people could have a look at the new facilities.

On a wall near the entrance, there was a plan of the ground floor:



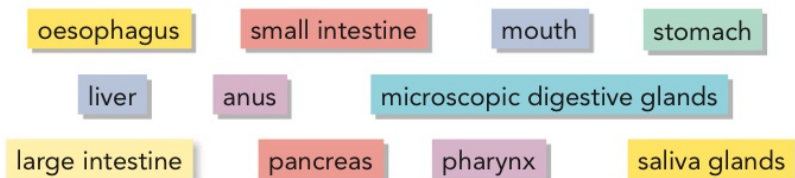
- A. Circulatory system
- B. Sensory organs
- C. Digestive system
- D. Reproductive system
- E. Urinary system
- F. Respiratory system

- Which rooms (1-6) correspond to the care of which aspects of the human body (A-F)?

2. In Room 1, there were different things to stimulate the senses. There were objects with different surface textures, perfumes, foods, etc. Think about two objects that this room might have to stimulate the senses and write them in your notebook. Then, write a short text to explain why these two objects are useful in this room.



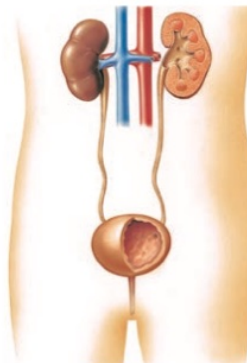
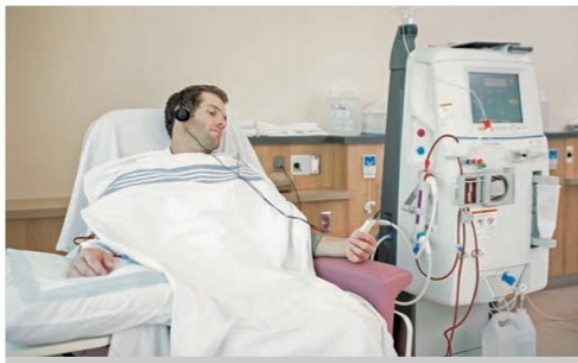
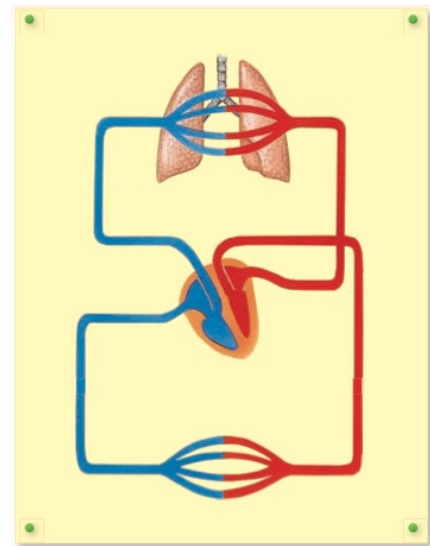
3. In the gastrointestinal clinic, there were posters to explain how the digestive system worked.



- In your notebook, put the parts of the digestive system in order, starting from where the food enters the body and finishing where the waste products are expelled as faeces. Indicate which phase of digestion each part is responsible for and mark where the different glands are located.

4. When visitors entered room 3, they saw this poster on the wall:
- What system from the human body is shown in the diagram?
 - Copy it into your notebook and name all the parts you recognise.
 - In pairs, explain the route that the blood follows and which gas is the most abundant in each stage. Start with the left auricle.
5. In room 4, medical staff performed breathing tests on volunteers.
- Complete the sentences in your notebook with the correct terms:
 - The exchange of gases between our body and the outside takes place in the pulmonary
 - In the alveoli, red blood cells take in oxygen and pass it into the
 - At the same time, ... passes from the blood to the alveoli and is expelled to the outside through the respiratory tract.
6. In room 5, a doctor told the visitors how dialysis machines worked and explained the functions of the urinary system:
- In your notebook, explain why the urinary system is important and the role of excretion in the life process of nutrition.
 - Can you explain what dialysis is and what happens during the procedure.

Write your answer in your notebook.



7. In the room where the antenatal classes take place, there are many books about the development of a human being during pregnancy.
- Get into four groups. Each group has to choose one of the four stages of development of the embryo or foetus:

embryo of 1 month

foetus of 6 months

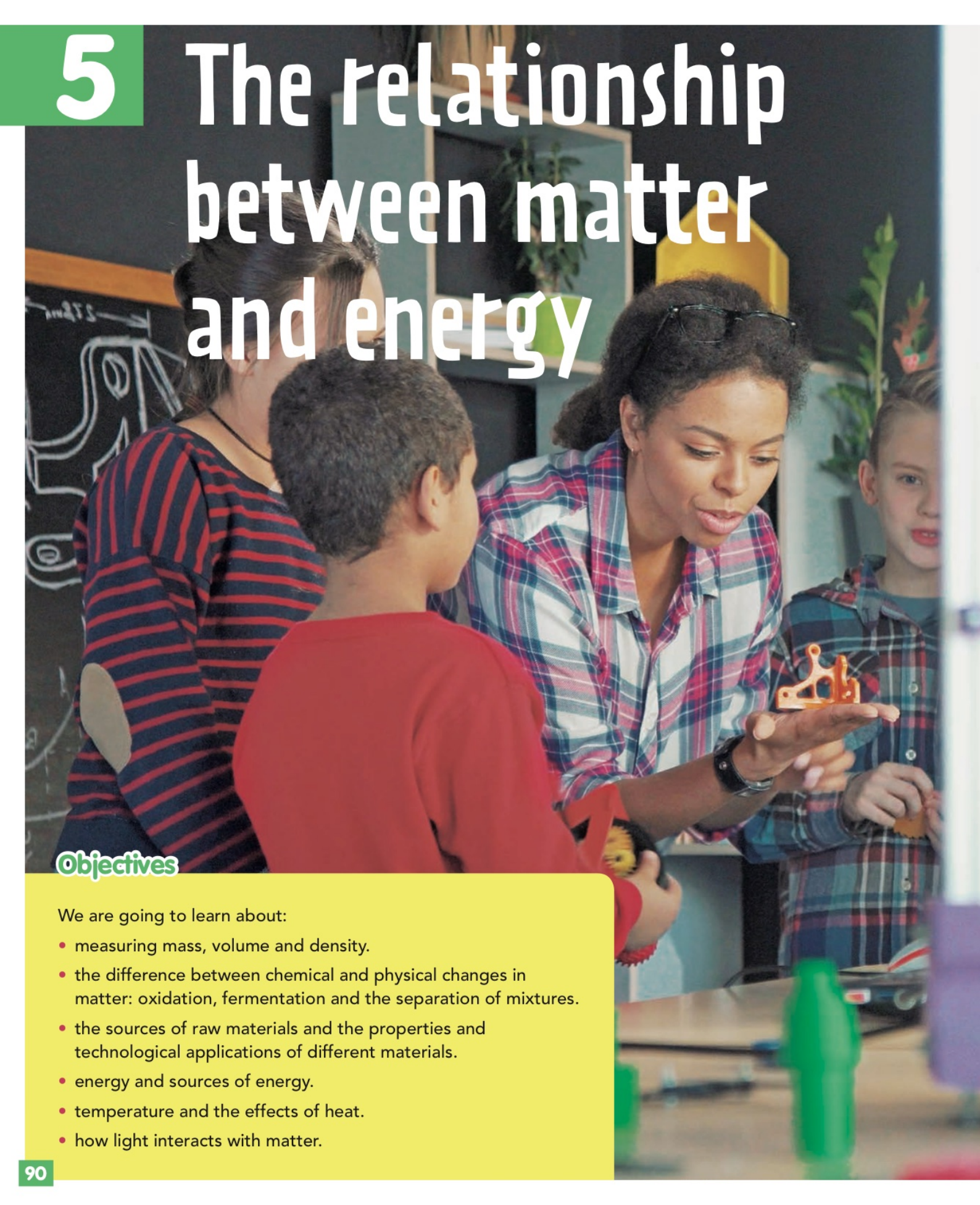
foetus of 3 months

foetus of 9 months

- Each group looks for information on the Internet and writes a short report on their stage.
- To finish, one spokesperson from each group reads the report aloud to the class. Together, talk about the stage you consider the most interesting and why.



5 The relationship between matter and energy



Objectives

We are going to learn about:

- measuring mass, volume and density.
- the difference between chemical and physical changes in matter: oxidation, fermentation and the separation of mixtures.
- the sources of raw materials and the properties and technological applications of different materials.
- energy and sources of energy.
- temperature and the effects of heat.
- how light interacts with matter.

57 Useful language

- One advantage is that (they can be just right for each person).
- A 3D printer (makes objects) while a normal printer (makes words or images).
- I will make (sculptures).

56 3D printed prosthetic Limbs

Guillermo Martínez is 23 years old and lives in Madrid. When he was a child, he always wanted to make his own toys.

A few years ago, 3D printers were very expensive. However, in 2017, the price of a 3D printer went down and Guillermo bought one for 150 euros.

Guillermo did not know how a 3D printer worked, but he taught himself with tutorials on YouTube and blogs. Then he started printing his first pieces and models.

A visit to an orphanage in Kenya changed his life forever. He saw children there who had lost a limb and he asked himself, "Can I make them prosthetic limbs using my 3D printer?" Shortly after his trip, he started to receive photos from adults and children who needed his help and so he started to make the limbs. Guillermo's initiative has been very successful and he now helps people all over the world.

Thanks to Guillermo, it is now possible to download a pre-designed prosthetic limb from the Internet.

Source: <https://ideassolidarias.org/protesis-impresas-en-3d-para-africa/> (translated and adapted) Referenced: March 2019.

1. What objects can you make with a 3D printer?
2. Guillermo Martínez founded an organisation called Ayúdame3D. Its motto is: "it doesn't take much to help someone in need". What is your opinion of this statement?

Think

- What are the advantages of making each prosthetic limb individually?
- What is the difference between a 3D printer and a normal printer?

Do you know?

- Do 3D printers use materials that are solid, liquid or gas?
- Do you know how to use a 3D printer?

Reflect

- Imagine you are an artist or a doctor, and you have a 3D printer. What will you make with it?
- Do you think we can only use plastic materials in 3D printers?

What is matter?

Everything around us, including ourselves, has one thing in common: it is made up of **matter**.

The properties of matter

Everything is made of **matter**. It has properties we can measure, such as mass, volume and density.

- The **mass** of a substance is the quantity of matter that it is made of. We measure mass in kilograms.
- The **volume** of a substance is the quantity of space that it occupies. We measure volume in litres.
- The **density** of a substance is the relationship between its mass and its volume.

$$\text{density (kg/L)} = \frac{\text{mass (kg)}}{\text{volume (L)}}$$

Density gives us an idea of how concentrated the mass is. We measure density in kilograms per litre.

- What properties of matter can we measure?

Density and buoyancy

The three balls on the right have the same volume but they are made of different substances. Will they float in a liquid? The answer depends on whether the density of the balls is greater or less than the density of the liquid.

Find and define:

- density
- buoyancy
- spoilage

States of matter and density

In nature, we can find matter in different states: **gas** (air), **liquid** (water) or **solid** (rocks).

Solids are usually denser than liquids and liquids are denser than gases.

If we put the three balls in water, the cork ball and the wooden ball will float, but the iron ball will sink. This is because cork and wood are less dense than water but iron is denser than water.



How to change the density of a liquid

The liquid has a lower density

Water is less dense than an egg so the egg sinks to the bottom of the glass.



We add salt.

When the salt dissolves in the water, the density of the water increases.

Equal densities

The density increases until it is the same as the egg, which floats in the middle of the water.



We add more salt.

When the salt dissolves in the water, the density of the water increases even more.

The liquid has a higher density

The water has a greater density than the egg so the egg floats on the surface.



An egg sinks in a glass of water because it has a greater density than the water. If we dissolve some salt in the water, the density of the water increases and the egg floats.

► Learn more: Chemical changes in matter

Matter can experience both chemical and physical changes.

Chemical changes, or **chemical reactions**, transform substances. For example, when we light a fire, the wood and oxygen transform into smoke and ash.

Oxidation

Oxidation is the chemical reaction that takes place when some substances react with oxygen and transform into other substances. There are different types of oxidation:

- **Combustion** takes place when oxygen reacts with combustible materials such as wood. Combustion produces light and heat.
- **Corrosion** occurs when oxygen reacts with metal. For example, iron becomes iron oxide (rust), which is a red substance.



We paint metal objects to protect them from corrosion.

The oxidation of some foods can change their colour and flavour. For example, when we cut open an artichoke, the centre starts to go black because of oxidation.



| **b** What does combustion produce?

Fermentation

Fermentation is a chemical change that produces organic substances. It does not need oxygen. The most common fermentation occurs with yeast, which is a type of fungus.

We use microorganisms when we ferment flour to make bread and in the fermentation of milk to make yoghurt and kefir.



kefir

Other fermentations such as food spoilage can be harmful to our health. It is important to keep food in dry and cool places and eat it before it spoils.



| **c** What is yeast?

► Understand, apply and reason

1. Describe two properties of matter.
2. Which of the following things can be classified as matter? Give reasons for your answers.

water	love	speed	air
salt	kindness	a line	cold
anger	oil	oxygen	a scarf
colour	wine	hydrogen	a finger

3. 1 L of a liquid has a mass of 0.78 kg. Calculate the density of the liquid.

4. What do you think happens if you put liquids with different densities in the same glass?

Go to www.tiching.com/726097 and watch the experiment. Then, discuss with a partner how the experiment worked.

5. Which of these objects do you think are denser than water and will not float? Design an experiment to find out the answer:

chewing gum – a cotton bud – a paper clip – a pencil – a cork – a spoon

What changes do not modify substances?

Physical changes occur when ice melts or water evaporates. The physical state of the water changes but the substance remains the same.

Physical changes of matter

Physical changes modify the appearance of matter but not its nature. For example, a physical change occurs when a substance changes state, when it is turned into a powder or when its components become separated.

a What is a physical change?

What is a mixture?

There are many forms of matter. In some cases, matter is made of one **pure substance** that has constant and defined properties. For example, salt is a pure substance. It always has the same density and it always melts at the same temperature.

In other cases, matter is a **mixture** of various substances and its properties depend on its components and their proportions.

Each substance in a mixture is called a **component**.

An example is granite. As you can see from the picture, granite is a rock that consists of three components: quartz, feldspar and mica. Mixtures like these are heterogeneous. Mixtures can also be homogeneous.

b What are the individual parts of a mixture called?

Heterogeneous mixtures

When you can see the components of a mixture, we say it is **heterogeneous**. Granite and fruit juice with pulp are heterogeneous mixtures.

Homogeneous mixtures

When you cannot see the individual components of a mixture, we say it is **homogeneous**. These mixtures are also called **solutions**. Seawater is a homogeneous mixture of water and various salts.

c What is the difference between a heterogeneous and a homogeneous mixture?

Find and define:

- homogeneous mixture
- heterogeneous mixture
- distillation
- solution
- decantation
- filtration

Find out more about pure substances and mixtures at:

www.tiching.com/752358



Steel is a homogeneous mixture of iron, carbon and other substances. The components have to be melted so they can be mixed together.

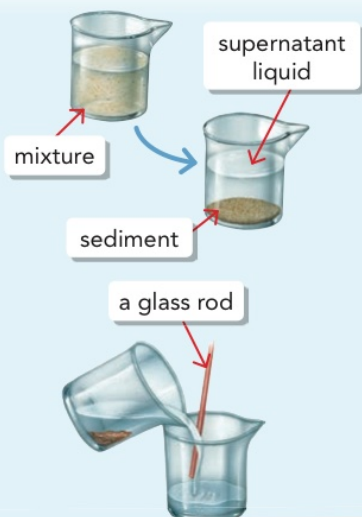
Separation techniques of mixtures in the laboratory

Sometimes we need to **separate** a mixture to obtain one of its components. We use different techniques to do this:

Decantation

The **decantation** technique allows us to separate a solid from a heterogeneous liquid mixture.

If the solid is denser than the liquid, it will form sediment at the bottom of the beaker. We can then separate the liquid from the solid by pouring it carefully into another beaker.



heterogeneous mixture of a solid and a liquid



Filtration

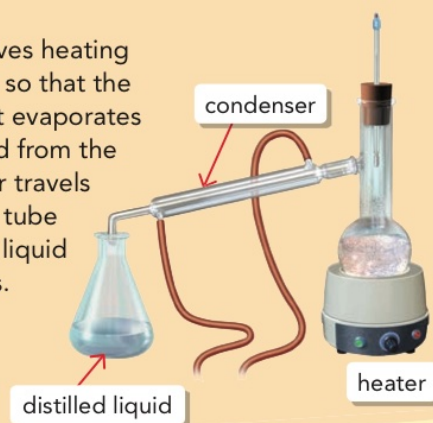
The **filtration** technique involves separating a solid from a liquid by passing the liquid through filter paper. The solid stays in the paper while the liquid passes through.

funnel with filter paper

filtered liquid (filtrate)

Distillation

The **distillation** technique involves heating a liquid mixture so that the component that evaporates first is separated from the rest. The vapour travels down a cooling tube and becomes a liquid again as it cools. This is then collected in a separate flask.



water vapour (steam)



Evaporation

The liquid **evaporates** and the dissolved solid crystallises. This happens when water evaporates from a saltwater solution.

Magnetic separation

This involves using a magnet to separate the metallic particles from a mixture.



- d Can you decant a homogeneous mixture?
- e What is the cooling tube used in the distillation technique also called?

► Understand, apply and reason

6. If we add sugar to a beaker of water and stir, what type of mixture will we get? What would happen if we added sand to a beaker of water?
7. Air is basically a mixture of oxygen and nitrogen. What type of mixture is air?
8. Which of the following liquid mixtures can be separated using decantation?
 - water and sugar
 - water and sand
 - milk and chocolate powder
 - water and iron filings
 - water and salt
 - fruit juice and pulp

Where can we find the substances we need?

We use natural resources called **raw materials** to make the different things we need. Raw materials can be of animal, vegetable or mineral origin.

Each substance that we use to make things is called a **material**. We obtain **natural** materials directly from raw materials, or we make **man-made** materials from natural materials.

What is a material?

Find and define:

• raw materials

• minerals

• rocks

Products of animal origin

Animals give us materials such as leather, wool and silk.



Products of vegetable origin

Plants give us very useful materials such as cotton and wood.



Products of mineral origin

Rocks are raw materials of mineral origin. We use many types of rock in construction and other types for sculpture.



Rocks are composed of **minerals**. Each mineral has a different composition and different properties. We extract metal from minerals.



Properties of materials

We use different types of materials to make objects. We choose materials according to their **properties**, and the function that they need to perform.

- Woollen fabrics keep us warm in winter.
- Electrical cables are covered with plastic to insulate the electricity they carry.
- A car windscreen is made of transparent glass, which is strong so it does not break easily.

Some materials have specific properties: ceramics are fragile, diamonds are hard and salt dissolves in water. Other materials are modified in the production process to give them properties such as colour, texture or smell.

b What properties does a car windscreen have?



Strength: if a material is strong, it is difficult to break.



Electrical conductivity and insulation: electrical conductors let electricity pass through, electrical insulators do not.

Sound insulation: acoustic insulators do not let sound waves pass through them.



Thermal conductivity and insulation: thermal conductors let heat pass through them, thermal insulators do not.

Water resistance: water resistant (waterproof) materials do not let water pass through them.



Understand, apply and reason

- Classify these materials according to their origin: leather - wood - silk - wool - cotton - gypsum.
- Name some objects which are made using materials of animal, vegetable or mineral origin.
- 61** Decide if these sentences are true or false. Correct the false sentences in your notebook. Then, listen and check.
 - Granite is transparent and used in windows.
 - Rocks are made up of minerals.
 - Raw materials are natural resources which we use to obtain man-made materials.
- 62** Listen to the descriptions of the materials and decide which object on this page is being described.
- Discuss the advantages and disadvantages of using different materials for each object with a partner:
 - A paper bag or a plastic bag.
 - A plastic cup or a glass.
 - A clay pot or a metal saucepan.
 - A wooden ruler or a metal ruler.
 - A leather sofa or a plastic sofa.

– I think a (plastic) bottle is good because it is (light) and (strong) and it (doesn't break easily).
- LS1** Use the Internet to find out about silkworm farming and what silk is used for. Write a short report about your findings.

the technological applications of materials

In recent times, the invention of materials with specific properties has led to many technological advances.

Tetra Brik

This light and compact carton packaging preserves food in ideal conditions. It contains different layers of materials:

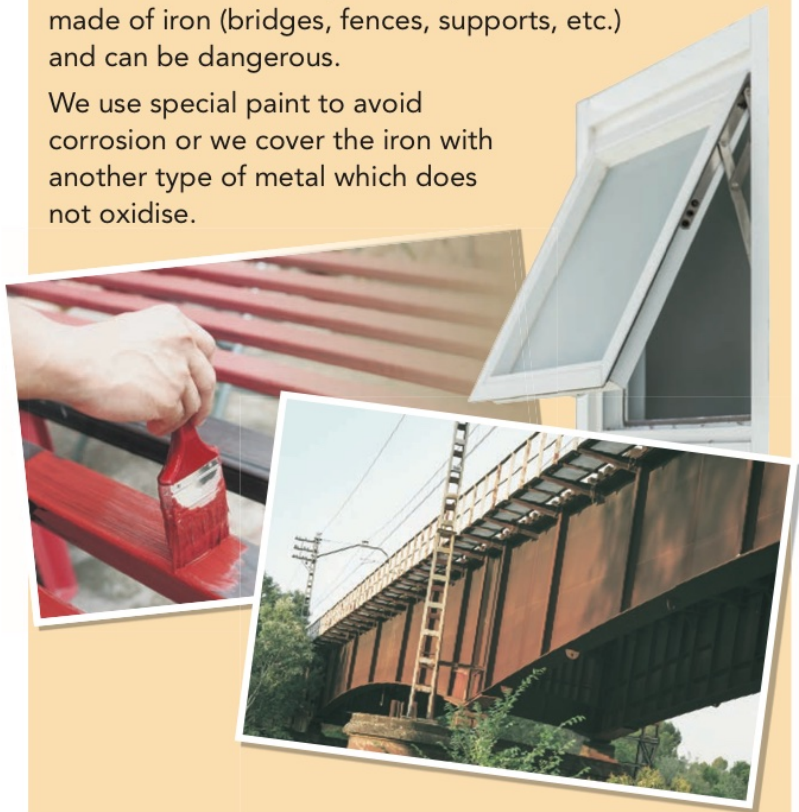
- 1 layer of aluminium (inside)
- 1 layer of special paper (middle)
- 3 layers of polythene (outside)



Protection against corrosion

The oxidation of iron (corrosion) weakens structures made of iron (bridges, fences, supports, etc.) and can be dangerous.

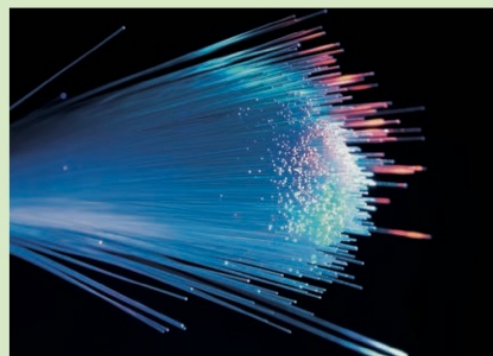
We use special paint to avoid corrosion or we cover the iron with another type of metal which does not oxidise.



Glass

Glass has many applications because it can adopt different shapes and it is transparent so we can see through it.

We use it to make glasses, bottles, windows, lenses, mirrors, and jars for preserving food.



Fibre optics is a recent application of glass.

Carbon fibre

New technologies have created useful new fibres and fabrics.

For example, carbon fibre was initially used in the aeronautics industry but now it is used in transport, construction, sports equipment and prostheses.

Carbon fibre is lightweight and very strong, which makes it a perfect material for making prosthetic limbs.



| a Why is glass such a useful material?

| b What are the properties of carbon fibre?

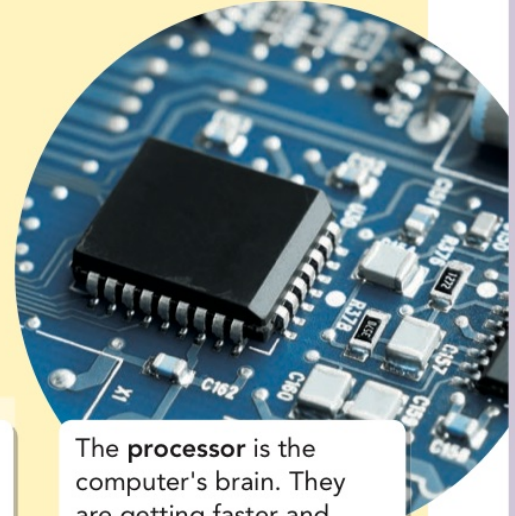
Computers

Computers were invented in the middle of the 20th century to do complex mathematical calculations quickly.

Nowadays, computers are used for many more things. We use them for storing information, processing texts, photos and videos, games and Internet communication.

A computer processor contains chips and circuits that are made of **semiconductor materials**.

Here are the main parts of a computer:



The **processor** is the computer's brain. They are getting faster and more powerful all the time.



screen

keyboard

mouse

An **external hard drive** has a very large memory capacity. It allows us to store and transfer large quantities of data.



A **USB stick** has a small memory capacity. We can use it to transfer data between different computers.



printer

Tablets



Tablets have a touch screen. They are very light and easy to use.

| C What are computers used for?

► Understand and explain

15. Technology has allowed us to create many new materials that did not previously exist. In pairs, find out about one of them and prepare a factsheet to explain what this material's properties are and what it is used for.
16. Carbon fibre is a very strong, flexible and light material that can resist very high temperatures.

Look on the Internet and make a list of objects that contain this material.

17. Talk with a partner about what you use computers for, and what people in the past did instead.
 - I use a computer to do my homework.
 - In the past, people had to write everything by hand.

What is energy?

Energy transforms matter. It is also needed to perform an activity. For example, a plant uses energy from the Sun to make food and grow.

Energy sources

We obtain energy from different **sources**:

- **Non-renewable** energy sources, such as oil, come from the Earth. Their supply is limited and they cannot be replaced.
- **Renewable** energy sources, such as the Sun, will never **run out**.

There are natural ways of storing energy, for example, plants use the starch in their seeds to store energy. There are also artificial ways, such as with man-made batteries.

- a What are the two main categories of energy sources?

Types of energy

There are different **types of energy**:

- **Electrical energy** carries electric current.
- **Thermal energy** (heat) passes from a hot substance to a colder one.
- **Mechanical energy** is produced when objects are moving. An example of mechanical energy is a windmill turning.
- **Chemical energy** is stored in the food we eat as well as in batteries and combustible substances.
- **Light energy** is transported by light. For example, from the Sun.
- **Nuclear energy** is obtained from the reaction of components in substances such as uranium. Nuclear energy is produced in nuclear power stations.

One type of energy can **transform** into another form of energy.

- b When is mechanical energy produced?

Transformation of energy



Mechanical energy from water is transformed into electrical energy in a hydroelectric power station. The electrical energy is transported through the electrical **grid** to cities, where it is transformed into light energy for lighting streets and homes.

Energy and sustainable development

These are the energy sources we use and the types of energy we obtain from them:

Non-renewable energy sources are running out and they cause pollution.		
Coal Coal is a rock that was formed millions of years ago.	Electrical energy Thermal energy	
Oil Oil is a liquid that was formed millions of years ago.	Electrical energy Thermal energy Energy for vehicles	
Natural gas Natural gas is a mixture of gases that is normally found with oil.	Electrical energy Thermal energy	
Uranium Uranium is found in different minerals in the Earth's crust.	Electrical energy	

The energy we consume comes mainly from sources of non-renewable energy. These energy sources are running out and they are causing serious environmental problems such as air, water and soil pollution; acid rain and radioactive waste.

This is why people are increasingly using renewable energy sources that do not produce waste, and also saving energy to contribute to **development**.

- C** What are the problems associated with non-renewable energy?

Renewable energy sources will never run out and do not cause pollution.

The Sun The Sun emits large quantities of light energy.	Electrical energy Thermal energy
Wind Wind energy is mechanical energy produced by the wind.	Electrical energy
Water Hydroelectric energy is mechanical energy produced by water.	Electrical energy
Biomass Organic materials store chemical energy.	Electrical energy Thermal energy



Vocabulary

run out: exhaust; use all of something until there is none left
grid: network

Understand, apply and reason

18. Listen and list the types of renewable and non-renewable energy sources you hear. Can you think of other examples?
19. Find out some information about starch. Why do we say that starch is capable of storing energy in plants?
20. Which type of energy:
 - a) does a battery store?
 - b) does an electric heater emit?
 - c) does a moving bicycle have?
 - d) does the electrical grid carry?
21. Make a list of electrical appliances in the home that transform electrical energy into thermal energy.
22. Say how energy is transformed in each of the following situations:
 - a) You turn on a fan.
 - b) You ring a doorbell.
 - c) You move your arm.
 - d) You turn on a lamp.
23. **LS₂** Research the advantages and disadvantages of different energy sources. Then, talk about how they compare.
24. What do we mean when we say the wind is a renewable energy source and natural gas is a non-renewable energy source?

heat and temperature

Thermal energy, or **heat**, is a type of energy that is transferred from a hot substance to a colder one.

We use thermal energy in many ways: for cooking and showering, and for heating our homes.

We talk about **temperature** when we measure how hot or cold a body is.



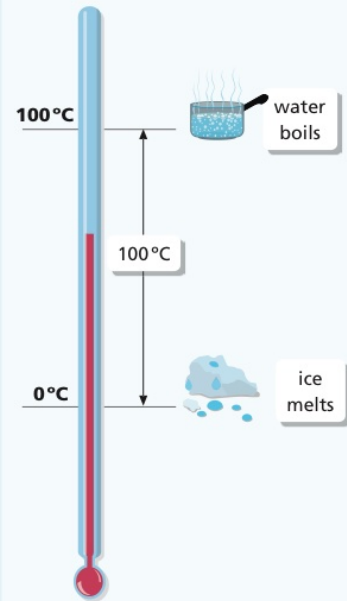
Measuring temperature

We measure temperature with a device called a **thermometer**.

The thermometers we use at home measure temperature using the **Celsius** scale.

On the Celsius scale, 0°C indicates the temperature that ice melts at and 100°C indicates the temperature that water boils at.

The Celsius scale



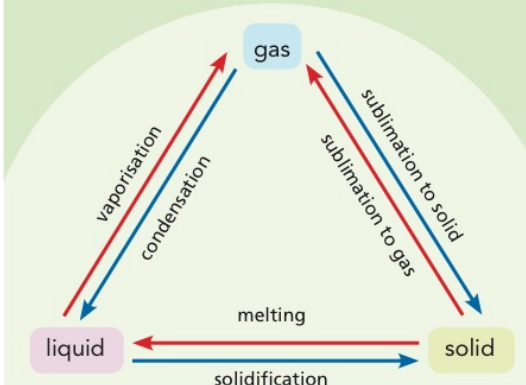
a At what temperature does ice melt?

Heat and changes of state

Matter can be solid, liquid or gas.

Substances can **change states** if their temperature increases (heating) and if their temperature decreases (cooling).

b What are the three states of matter?

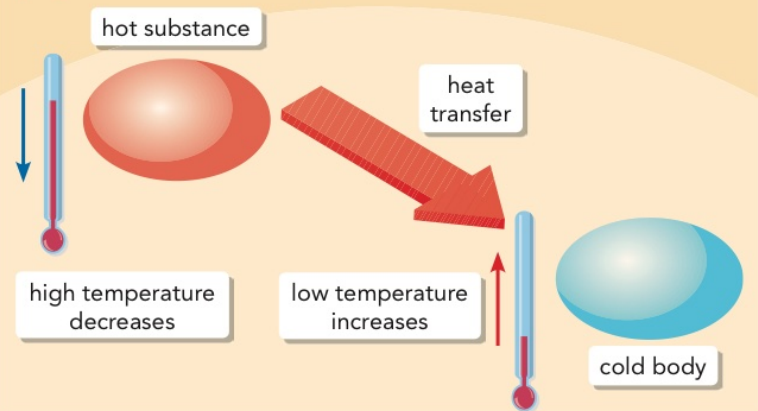


Heat and temperature of a substance

A substance **gets hotter** when it **receives heat** and it **gets colder** when it **transfers heat**.

This transfer of heat energy continues until both substances have the same temperature. At this point we say that the substances are in **thermal equilibrium**.

c What is thermal equilibrium?



Effects of heat on the size of a substance

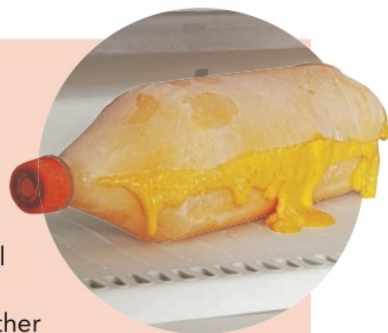
One effect of heat on a substance, is to **change its size**:

- When a substance is **heated**, it normally increases in size. We call this **expansion**.
- When a substance is **cooled**, it normally decreases in size. We call this **contraction**.

Water acts differently to other substances when it cools. When it freezes, it expands instead of contracting. This is why a bottle of water in the freezer can burst (explode).

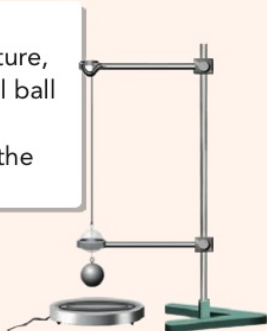
d What happens to water when we freeze it?

It is not a good idea to keep full bottles of water or other drinks in the freezer. When the water or the drink freezes, it expands and can break the bottle.



Expansion of solids

At room temperature, the metal ball passes through the ring.



When we heat the ball, it expands and does not pass through the ring.



Expansion of liquids

At room temperature, the alcohol level is a little above the bung.



When we heat the flask, the alcohol expands and moves up the tube.

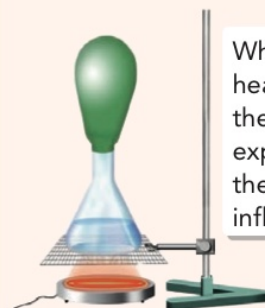


Expansion of gases

At room temperature, the balloon hangs deflated from the flask opening.



When we heat the flask, the air inside expands and the balloon inflates.



Observe and find

25. Which scale do we use to measure temperature? And which device do we use to measure it?
26. We know that water is unusual because it expands when it freezes. Why do you think other drinks also expand in the freezer?

27. A cup of hot coffee cools down over time. Why? What has the coffee transferred heat to?
28. Why do some windows open easily in winter but not in summer? Use the words **contract** and **expand** in your answer.

light

Light is a type of energy that is emitted by luminous objects and substances. We use our **sense of sight** to perceive it. Because of light we can see the shape, size and colour of things that surround us.

Light travels in straight lines from the light source to the object it illuminates.

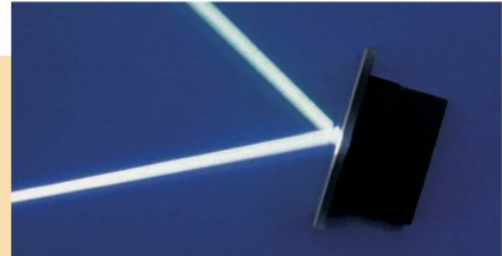


Reflection

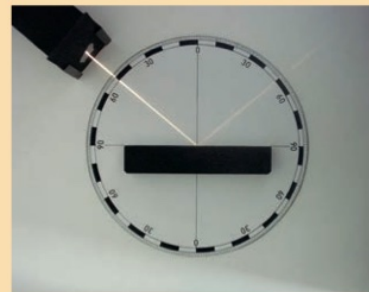
When light hits an object, it can either pass through it or it is **reflected** in a process called the **reflection of light**. We can see an object because it reflects the light.

The reflection of light can be seen in mirrors and on other smooth surfaces such as calm water on a lake. In the reflection, you will see a **mirror image** of the object (an identical, but reversed, image).

a When does reflection of light occur?



The ray of light hits the mirror and is reflected. When a ray of light hits a different type of surface, not all of that light is reflected.



The angle of light that hits the mirror (the incident ray) is the same as the angle of the reflected light (the reflected ray).

Refraction

Refraction of light takes place when light passes from one transparent medium to another. For example, this happens when light passes from air to water.

Refraction explains why an object looks slightly **bent** when it is partially submerged in water.

It happens because the image of the object changes direction when light passes from water to air.

b When does refraction of light occur?



Vocabulary

bent: inclined

Effects and applications of refraction

Prisms

The colours that make up white light all have different angles of refraction. Objects such as prisms separate the white light into its component colours.



Lenses

Lenses are pieces of glass or plastic in the shape of a disc. We use lenses to refract the light that passes through them.

When light passes through a lens, refraction changes the image of the objects we are looking at. They become clearer or bigger, which is what happens when we use a magnifying glass.



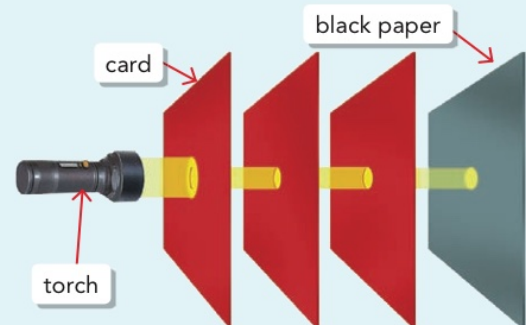
| **C** What happens when light passes through a lens?

Experiment to see how light travels

The following experiment demonstrates how light travels in straight lines:

- Cut out three pieces of 15x15 cm card. Make a small hole in the centre of each piece.
- Align all the pieces of card and leave a gap of around 5 cm between each.
- Hold a torch in front of the first piece of card so that the light passes through the hole. Put a piece of black paper behind the last piece of card. Can you see a small spot of light in the centre of the black paper?

What happens if you move one of the pieces of card?



Find out more about experiments with light at:

www.tiching.com/777581



► Observe and find

29. Which optical phenomenon:

- makes a pencil in a glass of water look bent?
- makes a goldfish look bigger than it really is in a round fish bowl?
- lets us see our image in a mirror?

30. What devices that use lenses do you know? What are they used for?

- 31.** Work in groups of three or four pupils and do the experiment that shows how light travels in straight lines. Then, write about your experiment. Include the material you used, the parts of the experiment and your results.
- First, we got some card and a pair of scissors.
 - Then, we cut the card into three pieces.
 - After that, we made small holes in the centre of each piece.

do a laboratory experiment

We are going to do an experiment to find out more about combustion. This experiment must take place under adult supervision. Please read the safety precautions carefully.



Studying combustion

1 What happens in combustion?

Plan

We are going to study what a combustion reaction needs to continue burning. It is important to follow the safety precautions.

Procedure

- 1 Pour some water onto plate A and put it on a table. Be careful not to overfill it. The water will stop air from entering the glass.
- 2 Place a candle in the middle of the plate.
- 3 Light the candle and observe how it burns.
- 4 Cover the whole candle with a glass. Write down what happens.

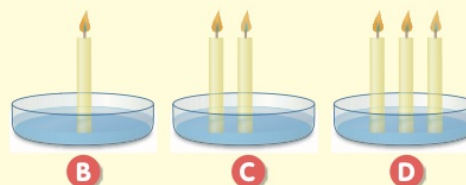
Analysis

Describe what happens after you cover the candle with the glass. Why does the candle stop burning?

- 5 Remove the glass from plate A, put the other plates on the table, and add water to them. Put one candle on plate B, two candles on plate C and three candles on plate D.
- 6 Light the candles on all four plates carefully.
- 7 Cover all the candles on plates B, C and D.

Materials

- four plates: A, B, C and D
- three glasses
- seven candles



Analysis

In which order do the candles go out?

2 Fire safety

It is important to be very careful around fire because it can get out of control very easily.

When you are doing experiments with fire, follow these fire safety precautions:

- Ask an adult to supervise you.
- Do not do the experiment near any flammable materials. These are materials that catch fire easily, such as alcohol or paper.
- Make sure you have easy access to a fire extinguisher in case of an accident.

BE CAREFUL!

Follow all necessary safety precautions and do the experiment under adult supervision.



smoke detector



fire extinguisher

3 Fire safety precautions when using candles

- ✓ Put the candles on a firm, non-flammable base, such as a plate. It should be big enough to catch any wax which falls off the candles.
- ✓ Be very careful when you light the candles, especially if you are wearing loose clothing or have long hair.
- ✓ When the candles go out, be careful with the wax as it will still be hot.
- ✗ Don't leave the room until you are sure that the candles are fully extinguished.
- ✗ Don't leave burning candles unattended.
- ✗ Never put a lit candle:
 - less than a metre away from flammable materials.
 - near windows or doors where air currents could cause materials close by to catch fire.



Apply what you know

- Find out about the different types of fire extinguishing systems that exist.
- LS₃** Write a hypothesis for what a combustion reaction needs to continue burning, based on the results of your experiment.
- Could you light a candle on the Moon?
- 68** Complete the following sentences in your notebook. Then, listen and check:
 - Materials that burn easily are called ... materials.
 - You can use a fire ... to put a fire out.
 - If we cover a candle with a glass, it will quickly ... burning.

Make an information leaflet about sources of energy

Each group is going to make a leaflet that you can hand out to other students at your school.

You are going to do some research about the characteristics of renewable and non-renewable energy sources as well as their advantages and disadvantages. The following information will help you to design your leaflet.

Group structure:

5 - 6 pupils in each group.

Functions or roles of group members:

Coordinator: receives instructions from the teacher and manages time.

Secretary: is responsible for the group's written tasks.

Time: 45 minutes in each session.

1 Get into groups of 5 or 6 pupils. Each group is going to design a leaflet that will include information about non-renewable and renewable sources of energy.

You can use a computer program to design the leaflet. It must include text, images and diagrams. The message that you want to transmit should be clear and visually attractive. Remember to add your names to the leaflet.



2 Decide together which tasks each pupil in your group will do. You need to find out detailed information about non-renewable sources of energy (coal, oil, gas and nuclear) as well as renewable sources of energy (solar, hydro (water) and wind). Remember to include information about the advantages and disadvantages of each one.

The secretary of each group takes notes and each member of the group writes their own text and choose the images to put in the leaflet.

Oil: _____

Reserves: _____

Extraction	Refineries	Oil derivatives
_____	_____	_____
_____	_____	_____
Pollution	Pollution	Pollution
_____	_____	_____
_____	_____	_____

The Sun: _____

Reserves: _____

Light energy: _____

Thermal energy: _____

Pollution: _____

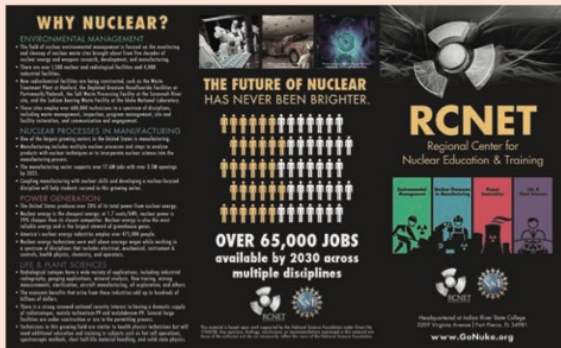
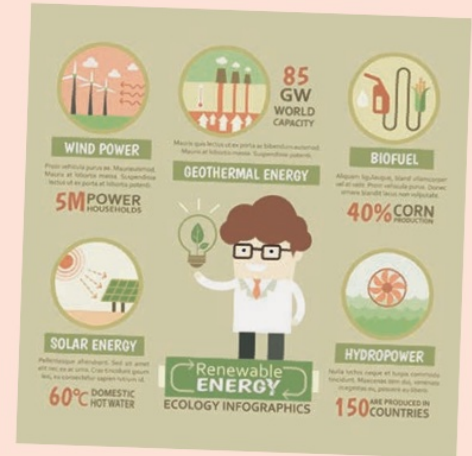
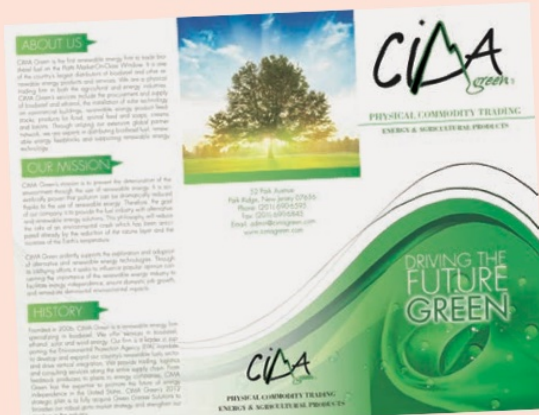
3

When you have finished your leaflet, show it to the rest of the class. Compare and comment on all the leaflets with your classmates and hold a vote to choose the leaflet that transmits the clearest message and that attracts the reader's attention.

Here are some examples of how to include text and pictures in your leaflet:

To find out more about how to design a leaflet, go to:

www.tiching.com/777584



4

Get permission from the school to print your class leaflet about the sources of energy. Hand out copies to the other students at your school.

Think and answer:

- What did you think of this activity? Was it difficult to divide up the different tasks among the members of your group? Did you need to ask your teacher for help?
- Was it difficult to do the necessary research?
- After making your leaflet, which sources of energy do you think we should be using more of?
- What have you learnt about the sources of energy? And what about the graphic design of an information leaflet?

Now I know...

- Copy and complete the sentences in your notebook:
 - The three main properties of ... are mass, ... and density.
 - We calculate density by dividing ... by ...
 - Oxidation and fermentation are examples of ... changes in matter.
 - Combustion and ... are examples of oxidation.
 - We make steel from a mixture of iron and ...
 - We can use decantation and filtration to separate a liquid from a ... in a ... mixture.
 - Materials can be ... or man-made.
 - Different materials have different ..., such as strength and conductivity.
 - ... sources of energy are limited and will run out.
 - Heat moves from a ... body to a ... one.
- Which separation technique is used to separate sea salt from sea water? Do some research and find out how long people have used this technique for.
- Which object could be used on a waste conveyor belt to separate objects made of iron from the rest of the rubbish?
- The following sentences are all advice for situations that involve combustion. Match the sentence halves and write the complete sentences in your notebook:

a) When we use a fire extinguisher to put out a small fire...	1) ...cool and dry place at home.
b) Do not light a fire in the mountains because...	2) ...it can easily spread to nearby bushes and trees.
c) Close the lids of combustible products and...	3) ...we prevent oxygen from reaching the fire and it goes out.
d) Keep all flammable products in a...	4) ...keep them away from heat sources and electrical sparks.
- Explain how energy is transformed in these household appliances.

oven

juicer

hair dryer

toaster

iron

vacuum cleaner

television

electric mixer

radiator
- Look at this picture of a glass and a straw. Which optical phenomenon can we see in the picture? Give a short explanation.



Remember, it is important to go to the Gym to do some exercises.



- Decide if the following expressions belong in the introduction, the main body or the conclusion of a report. Then, use them to help you do activity 14 on page 97.

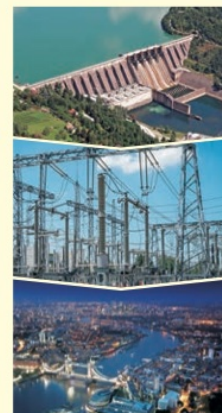
- Another finding is...
- In conclusion...
- One important use of silk is...
- We discovered that silk farming is...
- According to (name of website)...
- The purpose of our report...
- Our research is about...
- To summarise...



Example: *The purpose of our report is to find out about silkworm farming in the world today.*

- Make the following adjectives into comparatives and superlatives. Then, use them to help you do activity 23 on page 101.

Adjective	Comparative	Superlative
clean	...	...
dirty	...	...
dangerous	...	...
difficult to obtain	...	...
damaging for the environment	...	...
expensive to produce	...	...
cheap to produce	...	...



Example: *Wind energy is **cleaner than** coal.*
*Uranium is **the most dangerous** energy source.*

- Put the examples of hypotheses in the correct order. Then, write your own hypothesis for activity 33 on page 107.

- If you / it will boil / heat water
- you will be tired / run for 10 km / If you
- it will drop / drop a ball / to the ground / If you
- at night / more difficult to sleep / If you / drink coffee / it will be



6

How does the world move?

Objectives

We are going to learn about:

- forces as transmitters of energy
- machines that use different types of energy: mechanical, electrical, thermal, etc.
- the characteristics of electricity.
- electrical circuits and how to represent them graphically.
- the relationship between magnetism and electricity, and why it matters.

70 Useful language

- The pointed wire (attracts the lightning).
- Electricity is important because (lots of machines use it).
- These days, we produce electricity (in power plants).

69 The kite

A kite made from silk is stronger than a paper kite but it flies just as well.

At the top of the kite there is pointed wire to attract the electric fire in the storm. At one end of the string, close to your hand, we attach a key.

When a thunder cloud appears above the kite, the pointed wire attracts the electric fire and so the kite and string become electrified. The loose filaments of the string stand up and they will be attracted to a finger if you move it close to the string.

When the kite and string are wet from the rain, they can conduct the electric fire even more. If you move your finger towards the key you will see sparks of electricity. You can use this electric fire to perform all sorts of electric experiments and even to burn alcohol.

This therefore clearly demonstrates that electrical matter is the same as lightning.

Benjamin FRANKLIN: *El experimento de la cometa*
(translated and adapted).
The Pennsylvania Gazette, October 19, 1752.

1. What do you think would happen if the 'electric fire' from lightning reached the person holding the kite?
2. At the end, the article says that electrical matter is the same as lightning. Why?

Think

- What is the difference between thunder and lightning?
- What does the pointed wire at the top of the kite do?

Do you know?

- Would you like to know if the electricity in a bolt of lightning is the same as the electricity in the sockets in your house?
- Do you know how to use electricity safely?

Reflect

- Why is electricity important today?
- Has the way we produce electricity changed since 1752?

What do forces transmit?

Forces transmit energy, which is the ability to produce change. Energy can deform an object or cause it to change its motion.

a What does force transmit?

Find and define:

- force
- speed
- elasticity
- plasticity

Forces deform objects

If we apply a force to an elastic or deformable object, we change its shape. However, when we stop applying the force:

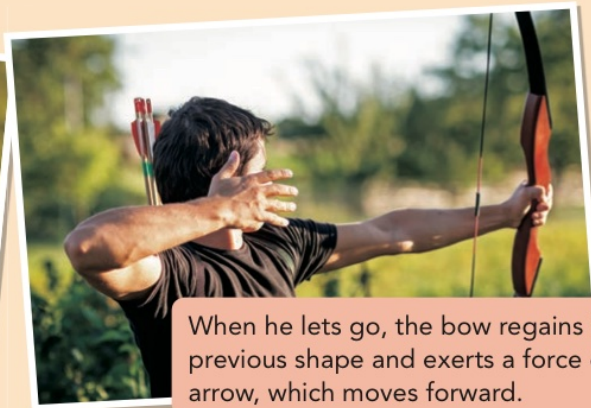
- an **elastic** object returns to its previous shape. This property is elasticity.
- a **deformable** object maintains its new shape. This property is known as **plasticity**.

Find out more about archery at:

www.tiching.com/777411



The archer applies a force that deforms the bow and transmits energy.



When he lets go, the bow regains its previous shape and exerts a force on the arrow, which moves forward.

Force applied to a ball of modelling clay changes its shape. Since it is a deformable material, it maintains its new shape when the force disappears.



A material that is neither elastic nor deformable will not change shape, but may break if there is sufficient force. Even elastic materials have a breaking point.

b Is modelling clay elastic or deformable?

Forces move objects

Forces have special characteristics:

- A force has a value, or **intensity**. A force with more intensity will have more effect on the object it acts on.
- A force acts along a **line of action**, for example, left and right, or up and down.
- A force also has a **sense**. For example, if we push an object, it will move forwards; but if we pull it, it will move backwards.

Therefore, the result of a force depends on its intensity, line of action and sense.

| c What are the special characteristics of a force?



The force that the hand applies to the hose changes the line of action of the stream of water.



Why does the stream of water fall as it moves forward? Because the **force of gravity** pulls it towards the ground.

The force of gravity is responsible for keeping us on the Earth's surface.

| d What force keeps us on the Earth's surface?

Force and speed

Force changes the speed of an object: it can increase it or decrease it. It can also change the object's line of action.



The bowler applies force to the ball, which puts it in motion. Friction slows it down.



Gravity pulls us all towards the Earth's surface no matter where we are.

► Understand, apply and reason

1. San Francisco, in the USA, sometimes suffers from very strong earthquakes. Do you think the buildings there have elastic properties. Are they rigid or are they deformable? Why do you think that?
2. Very tall buildings have elastic properties. Why do you think that is?
3. How are elastic materials different from deformable materials?
4. Gravity is a force that acts at a distance, i.e. it does not need to enter into direct contact with an object to change its shape or motion. Look on the Internet to find other forces that act at a distance.

What moves machines?

Machines are devices invented by humans to make work easier.

Some machines, like a lever, a pulley or an inclined plane, use mechanical energy to transmit force. They are **mechanical machines**.

Others, such as **electric machines** and **thermal machines**, use different kinds of energy.

- a What are machines?
- b What type of energy does a lever use to transfer force?



The washing machine is an electric machine, because it uses electrical energy.

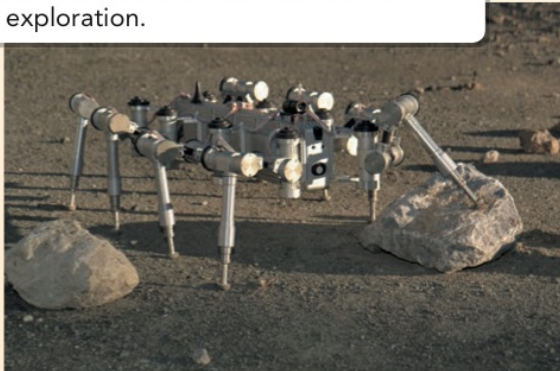
An aircraft engine is a thermal machine. It uses the thermal energy produced by the burning of fuel to move the aeroplane.



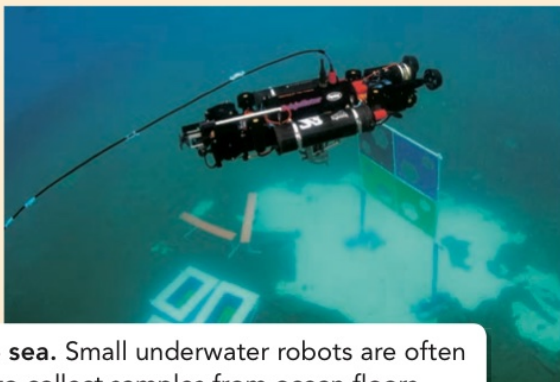
Robots

Robots are computer-controlled machines designed to carry out jobs that are repetitive, difficult or dangerous for humans.

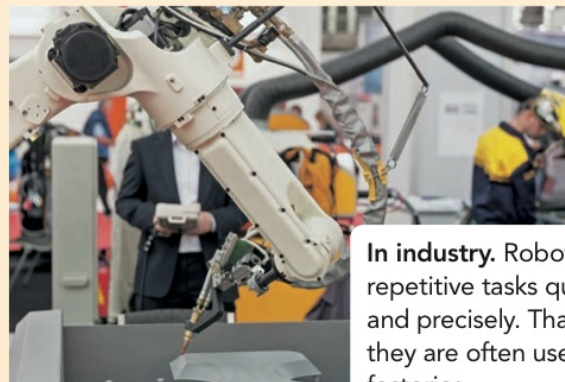
In space. Robots are an essential part of space exploration.



In medicine. Today, surgeons commonly operate using very precise robotic devices.



In the sea. Small underwater robots are often used to collect samples from ocean floors.



In industry. Robots can do repetitive tasks quickly and precisely. That is why they are often used in factories.

- c What are robots?

Learn more: Structures

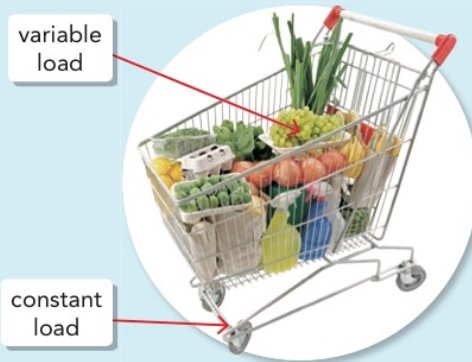
It is important that machines and buildings can **withstand** forces without falling or breaking. To do so, they must have a stable and strong structure.

Structure refers to the way in which the different parts of an object (machine, building, etc.) are put together.

These objects must withstand three types of force:

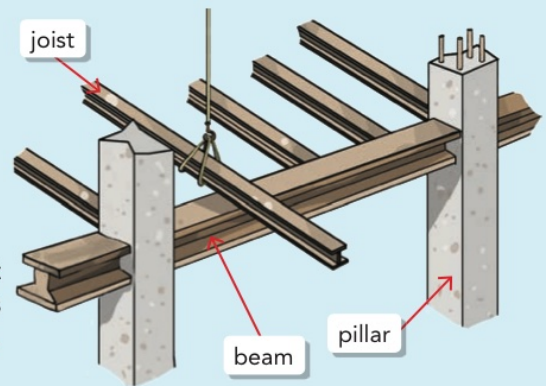
- **Constant.** Weight of the object (machine or building).
- **Variable.** Weight of what the object holds.
- **Environmental.** Forces external to the object.

For example, the structure of a supermarket shopping trolley must withstand the weight of the material it was built from (constant load), the weight of the shopping (variable load) and accidental **knocks** (environmental load).



The structure of the shopping cart is made from metal rods. When used normally, it does not overturn or break.

The structure of most buildings consists of a series of pillars, beams and joists.



Modular structures

Structures such as shelves and prefabricated houses are sometimes **assembled** using separate components that fit together, known as modules.

They are easy to transport, assembled, dismantle and can be organised into many different objects.



d What does the word 'structure' refer to?

Vocabulary

withstand: resist

knocks: impacts

assembled: put together

Understand, apply and reason

- What do we call machines that use mechanical energy to transfer force?
- What kind of energy does a thermal machine use? What about an electric machine?
- Classify these machines as electric or thermal:

– fan	– dryer
– steam engine	– vacuum cleaner
- What are some uses of a robot?
- What can happen to a structure that is not stable? What if it is not strong?
- Find out the difference between a robot and an android.
- 73 Complete the sentences below in your notebook. Then, listen and check:
 - Levers, pulleys and ... planes are all mechanical
 - We often use ... to help with dangerous work.
 - A machine or ... must be able to withstand constant, ... and environmental loads.
 - Printers, fans and toasters are all ... machines.
 - ... are vertical structural elements. Beams and ... are horizontal.

What are the characteristics of electricity?

Electric charge is a property of matter that manifests itself, for example, as an electric shock upon contact with a metallic object.

Electric current is the motion of electric charge through a material.

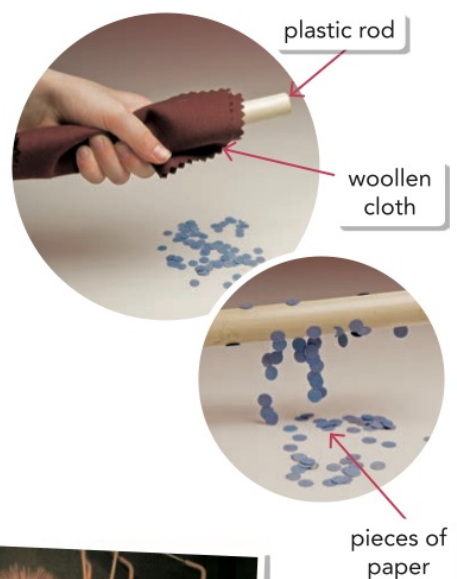
Electrification

Electric charges can be **positive** (+) or **negative** (-). If we **electrify** an object so that it has an excess of one charge, we say it is **electrically charged**.

This happens, for example, when you rub a plastic rod and a piece of woollen cloth together. The charge is transferred between the wool and the plastic, giving the rod a negative charge and the woollen cloth a positive charge.

When an object is electrically charged, it attracts light objects, such as little pieces of paper.

- a** What happens when you rub a plastic rod on a piece of woollen cloth?



An astonishing experiment

Some science museums have a **Van der Graff generator**: a large, negatively charged metal ball. When you touch it, it transfers a negative charge to your body.

Individual hairs all receive the same type of charge and so they repel each other and stand up straight.



Forces between charged objects

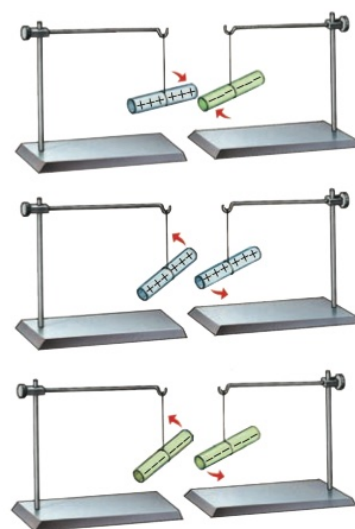
Objects can be classified based on whether they have more of one charge or the other:

- If an object has the same amount of positive and negative charge, it is **neutral**.
- If an object has more positive charge than negative, it is **positively charged**.
- If an object has more negative charge than positive, it is **negatively charged**.

Charged objects exert **forces** on one other:

- Two charged objects with **opposite charges attract**.
- Two charged objects with the **same charge repel each other**.

- b** What do we call an object with equal positive and negative charges?



Electric current and materials

When there is a flow of electric current, not all materials behave the same:

- Materials that allow electric current to flow through them, such as metals, are called **conductors**.
- Materials that do not allow electric current to flow through them, such as wood, glass or plastic, are called **insulators**.

C What is the difference between conductors and insulators?

The experiment below helps to show if a material is a conductor or an insulator. In this case the fork is a conductor so the light bulb lights up.



Current generators

For an electric charge to flow through a material and create electric current, it needs energy. Energy is produced by a **generator**.

There are numerous types of generators, from a simple battery that we use at home to large generators in power stations.



Electrification and electricity



Electrical wires are made from conductive metallic materials, normally copper, covered with insulating plastic.

Understand, apply and reason

12. According to tradition, it was Thales of Miletus who first made reference to electrical phenomena. Find out who he was and the origin of the word electricity.

13. ⁷⁵ Correct the following sentences in your notebook. Then, listen and check:

- Electric current is the property of an object that has a positive or negative charge.
- Opposite charges repel each other.
- An electric current can flow through glass because glass is an insulator.
- A light bulb is a simple generator.

14. Which of the following objects are made from insulating materials and which are made from conductive materials?



How does electrical energy reach us?

An **electric circuit** is a group of interconnected elements that allows us to generate, distribute and utilise electric current.

Simple electric circuit

A **simple electric circuit** consists of a battery, a light bulb and a switch connected by wires.

Electric circuits are shown graphically using diagrams. Universal symbols represent the parts of the circuit.

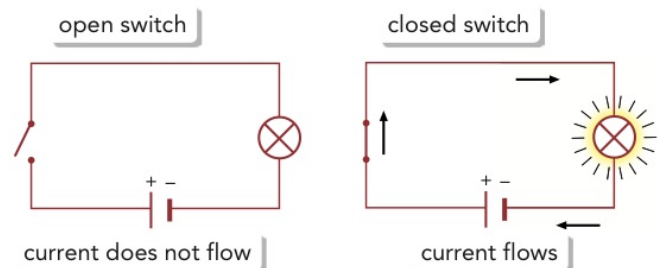
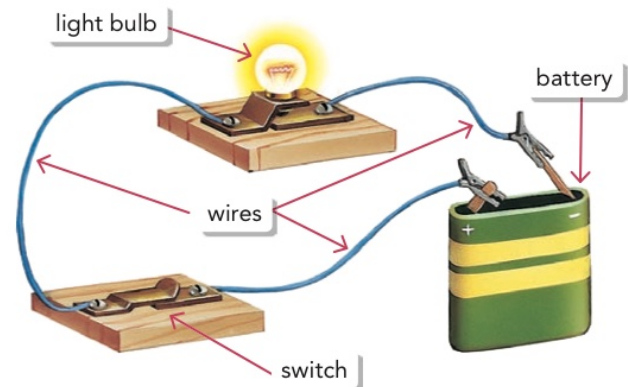
The switch has two symbols depending on whether it is open or not, i.e. if it allows or does not allow current to flow.

- a What is the difference between the two symbols that represent a switch?

Name	Symbol
Conductor	
Light bulb	
Battery	
Switch	

Find and define:

- electric circuit
- voltage
- current intensity
- electrical device



Voltage and current intensity

To describe electric current, we use two quantities: voltage and intensity.

Voltage tells us the electrical energy the current transports. It is measured in volts and the symbol is V.

The voltage that a battery generates is written on the side: 1.5 V, 6 V, 12 V, etc. The electric current in homes is 230 V.

Current **intensity** is the amount of electricity flowing through a circuit. It is measured in amperes and the symbol is A.

The brightness of a light bulb depends on the intensity of the electric current that flows through it.



Voltage and intensity in a circuit are measured with instruments known as multimeters.

Electrical devices

Electric current is used to power **electrical devices**.

These devices transform electrical energy into another type of energy that is useful for a certain application.

There are many types of electrical devices. Some can be found at home; others in industry and transport: computers, televisions, sound systems, air conditioning units, lighting systems, household appliances and car, motorcycle and scooter motors, etc.

b What powers electrical devices?



Electrical safety

Electrical installations must protect electrical devices and also guarantee people's safety.

To avoid getting an electric shock, you must follow these safety regulations:



Never use a household appliance in a humid environment (bath or shower) when your body is wet.



Never dismantle or use a dismantled socket unless the power has been turned off.



Never dismantle or repair a household appliance that is connected to the power supply.



Never plug an electric device in with wet hands or clean it while it is plugged in.

Understand, apply and reason

15. List the elements that are part of a simple electrical circuit.

Does electric current flow from the positive to the negative terminal, or from the negative to the positive terminal of a battery?

16. Explain what a switch does in an electric circuit.

17.  Look at the photos of electrical devices above and write down their names in your notebook. Now, listen to the sounds. Which devices do you hear?

Are electricity and magnetism related?

Magnets are objects made from materials that have the property to attract iron and some other metals. This property is called **magnetism**.

Natural and artificial magnets

There are two types of magnets depending on the origin of their magnetism:

- **Natural magnets** are made from materials like magnetite which are naturally magnetic.
- **Artificial magnets** are made from materials like steel that become magnetic after coming into contact with other magnets. The process of becoming magnetic is called **magnetisation**.

- What is a magnet?
- What are the two main types of magnets?

Magnetic poles

The magnetic properties of a magnet are strongest at the **ends**, known as **poles**. The ends of a magnet are called the **north pole (N)** and **south pole (S)**.

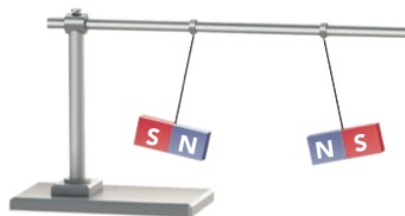
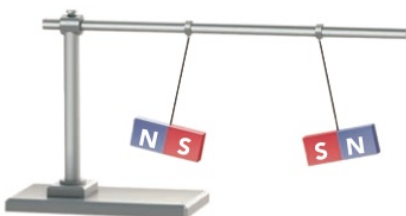
A magnet's poles cannot be isolated; you cannot have a magnet with just one pole. If we **split** a magnet in two, we get two full magnets, each with a north pole and a south pole.

- What happens when you split a magnet into two pieces?

Forces between magnets

When the poles of two magnets come together, the magnets exert **forces** on one another:

- When two **unlike** (different) poles are brought together, the magnets attract each other.
- When two **like** (same) poles are brought together, the magnets repel each other.

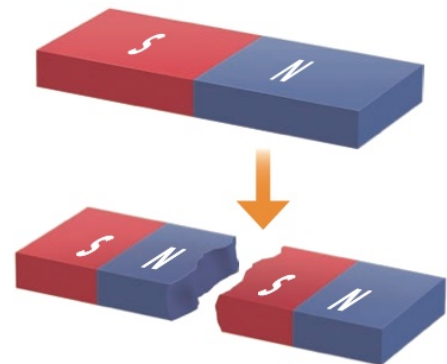
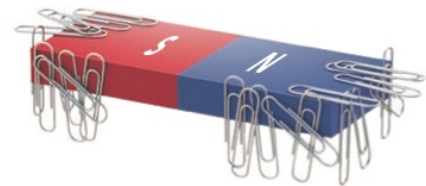


Find and define:

- | | |
|-----------------|-----------------|
| • Magnet | • Magnetic pole |
| • Magnetisation | • Electromagnet |



Magnetite is a magnetic mineral. It attracts objects made from iron and some other metals.



► Explore further: The relationship between electricity and magnetism

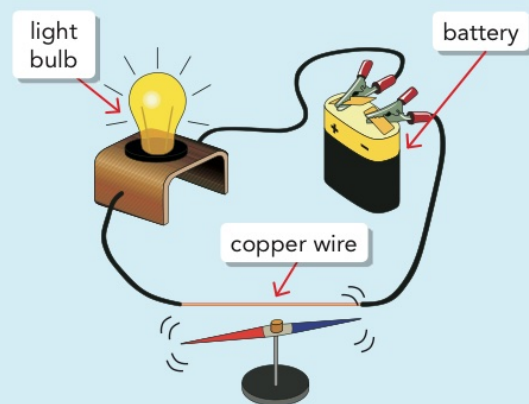
A compass consists of a magnet that spins freely on an axis and lines up with Earth's magnetic poles in a north-south direction.

If you place a compass near a wire that has electric current flowing through it, you will see that the magnet moves and points in the direction of the flow of the current.

If you stop the electric current, the magnet once again aligns itself with the Earth's magnetic poles. The conclusion is that **electric current generates magnetism**.

The reverse is also true, and magnetism can generate electric current. This two-way relationship is the basis of electricity generators and electric motors.

| d What is a compass?



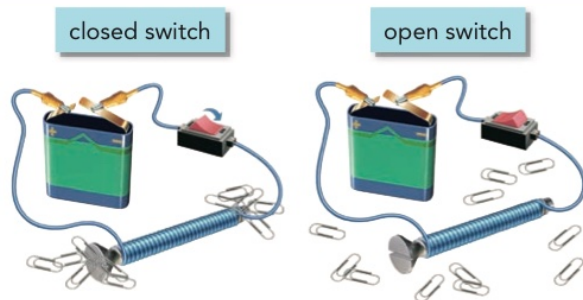
The light bulb is on. This tells us that there is a flow of electric current.

Electromagnets

If we **wind** a wire around an iron **screw** and connect the ends to a battery, we have an **electromagnet**.

In this kind of magnet, magnetism is generated by electric current.

An electromagnet acts like a magnet, but stops being magnetic when we turn off the electric current.



Vocabulary

end: final part
wind: cover in a circular motion

split: divide into two or more parts
screw: metal spike with raised spiral around it

► Understand, apply and reason

18. What is the property of magnets called?
19. What are a magnet's poles called? Can they be isolated?
20. What happens when you split a magnet in two?
21. What happens when the poles of two magnets come together? When do they attract and when do they repel each other?
22.  79 Say whether the following statements are true or false. Correct the false sentences in your notebook. Then, listen and check:
 - a) Magnets attract all metallic materials.
 - b) The properties of a magnet are strongest at the ends.
 - c) Some materials are attracted by electromagnets but not by magnets.
23. Explain how electricity and magnetism are related in the case of an electromagnet.
24. Look on the Internet for information about electromagnets. Find out three different uses of electromagnets. Compare your list with a partner and make a factsheet about electromagnets and their uses.

scientific and technological developments

We can see the technological applications of electricity and magnetism every day at home, as well as in industry, transport and communication.

They evolved quickly after they were first introduced in the 19th century.

Find and define:

- magnetic levitation
- magnetic resonance
- microwaves
- microphone

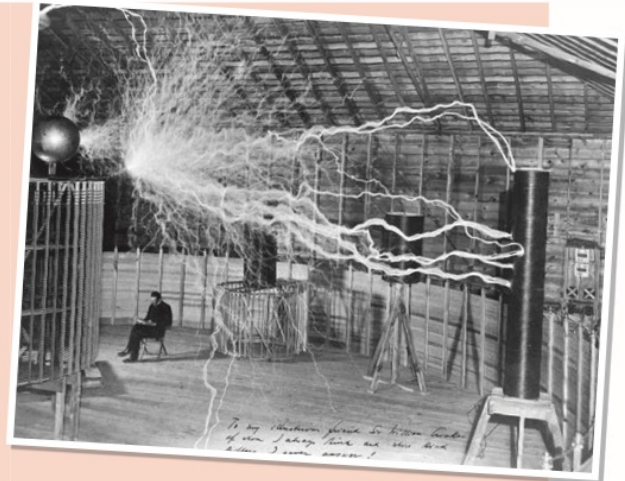
Use of electric energy

There are two types of electric current. At first, people used **direct current**, which is generated by batteries. The first generator to produce **alternating current**, the type we use at home these days, was built in 1832.

At the end of the 19th century there was a 'war of the currents' between Thomas Alva Edison and an engineer of Serbian origin called Nikola Tesla. It ended in 1895 with the construction of the world's first large hydroelectric plant, at Niagara Falls.

This showed that alternating current was superior in producing, transporting and distributing electric energy with the techniques available at the time.

| a What are the two types of electric current?



Tesla and the equipment he used to produce high frequency alternating current.

Magnetic levitation trains

Magnetic levitation involves elevating an object with magnetic repulsion. This kind of train runs above the tracks, with no friction.

| b What is magnetic levitation?



Magnetic resonance

This medical diagnostic technique produces detailed images of the organs and tissue of living things. To do so, it uses a large magnet and radio waves.

| c What does magnetic resonance use?

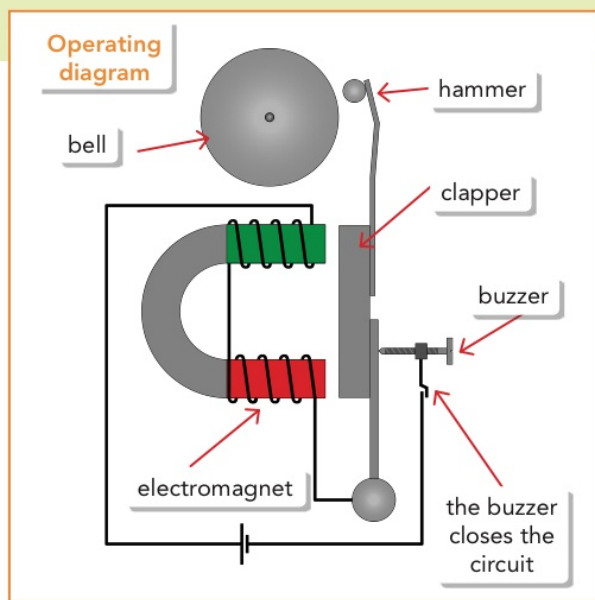


Everyday electromagnetism

Doorbells



Doorbells use an electric circuit that activates and deactivates an electromagnet, causing a hammer to strike a bell. Look at the operating diagram: when someone presses the buzzer, the electromagnet attracts the clapper and the hammer hits the bell. At the same time, the switch opens and the flow of current stops.



Microwave ovens

These household appliances heat food using microwave radiation, generated by a part of the oven called a *magnetron*.



Microphone

Microphones transform sound into an electrical signal using a diaphragm, an electromagnet and a circuit that transfers the generated current.



Magnetic cards

These cards have a magnetic band that stores information. The band contains particles that align like the poles of a magnet.

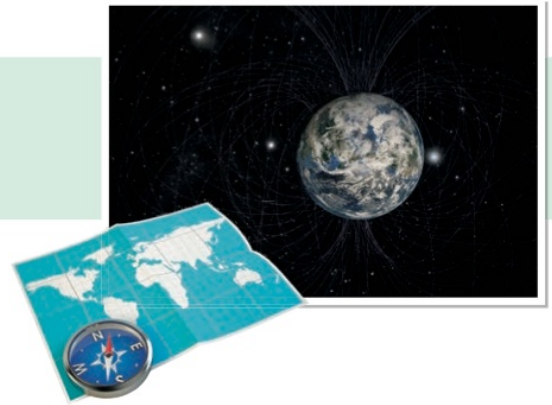


► Understand and explain

25. Look for biographical information about Nikola Tesla and make a list of his main inventions.
26. Find out if there are any hydroelectric plants near where you live. If there are, locate them on a map of your autonomous community.
27. Find information on the phenomenon of magnetic levitation and its applications. Make a factsheet about it.
28. Study the electric doorbell description above. What happens when the flow of electric current is interrupted if we keep pushing the button?

see magnetism

Earth is like a large magnet that generates an enormous magnetic field. This magnetic field lets us find our way with a compass, and also protects us from the Sun.



Explore magnetism further

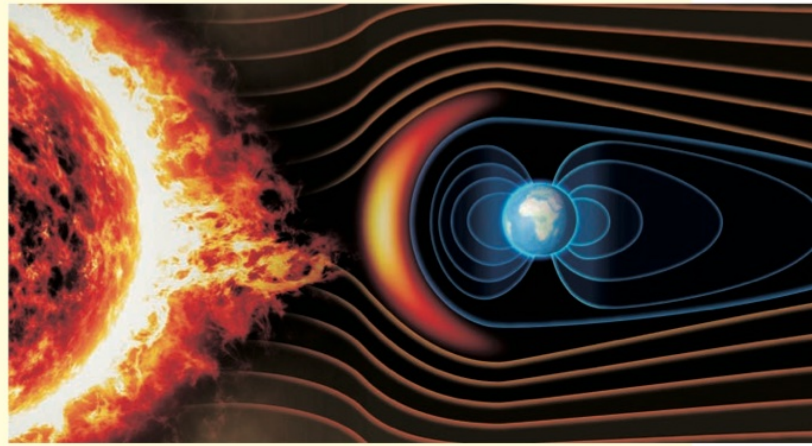
1 The protection provided by Earth's magnetic field

The Sun provides the light and heat that make life on Earth possible, but it also emits a stream of particles that are harmful to life.

Most of this stream, known as solar wind, is deflected by Earth's magnetic field in a region called the magnetosphere.

Without the magnetosphere, this stream of particles would reach Earth, causing the ozone layer to disappear, and communication and power networks to fail.

| a Where is the solar wind deflected?



2 How is an aurora borealis formed?

When the magnetosphere deflects the solar wind, some of the particles go towards the poles.

In these areas, the particles interact with gases in the atmosphere (nitrogen, oxygen, water vapour, etc.), resulting in visible radiation known as an aurora:

- An aurora borealis occurs in the Northern Hemisphere.
- An aurora australis occurs in the Southern Hemisphere.

| b What causes auroras?



3 How can I see magnetic field lines?

Approach

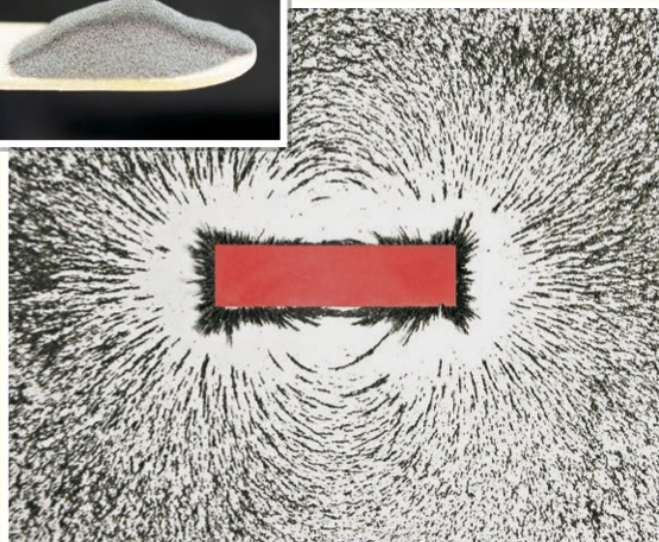
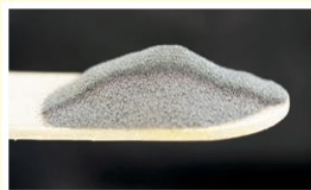
We are going to perform an experiment to see a magnet's magnetic fields, using iron filings.

Method

- 1 Take a sheet of white card and, with the tape, stick the magnet in the centre.
- 2 Turn the cardboard over and put it on a table with the magnet facing down.
- 3 Carefully sprinkle the iron filings over the entire sheet of card, putting more filings in the centre, on top of the magnet.
- 4 As you add more iron filings, you will see them group together to form lines that run from one magnetic pole to the other.
- 5 When you finish the experiment, take a photo or draw the magnetic field lines.

Materials:

- bar magnet
- card
- iron filings
- sticky tape



Analysis

Describe the shape of the lines.

Where are the iron filings closer together: close to or far from the magnet? What does this tell you about the force of the magnetic field?

Apply what you know

29. Draw what you think the magnetic field lines would look like if you used a horseshoe shaped magnet instead of a bar magnet. Then, try it out: tape a horseshoe magnet to a sheet of card, turn it over and add the iron filings.



Web detectives

30. Find out how solar radiation can affect communications.
31. Find photos of an aurora borealis and, with each photo, say where it was formed, its shape, colours, etc.
32. Find out why the Earth is magnetic and write a factsheet.

Test your knowledge of technology

Robots are machines designed to carry out heavy, difficult or dangerous jobs in the place of humans.

Today, robots have many applications: in industry, in medicine, in agriculture, in space exploration, in the home, etc.

With this activity, each group builds a simple robot with an electric generator. After you build it, share your experiences in a discussion session.

Group structure: groups of 5 pupils.

Functions or roles of group members:

Coordinator: receives instructions from the teacher and manages time.

Speaker: shares information with the rest of the class.

Secretary: is responsible for the group's written tasks.

Time: 45 minutes per session.

1 Create work groups

Create groups of 5 members. The secretary of each team is responsible for writing down the steps you take to build the robot.

It must include questions, explanations and diagrams.



Painter robot

can draw autonomously

Show the function of the robot

Materials required:

- plastic or paper cup
- 3 or 4 felt-tip pens
- battery holder and batteries
- direct-current motor
- small tube
- decorative elements

Steps and diagrams:

2 Divide the tasks

Each group member is assigned a task.

- Search for information.
- Organise the information.
- Design the robot.
- Build the robot.
- Organise the exhibition of all the robots.

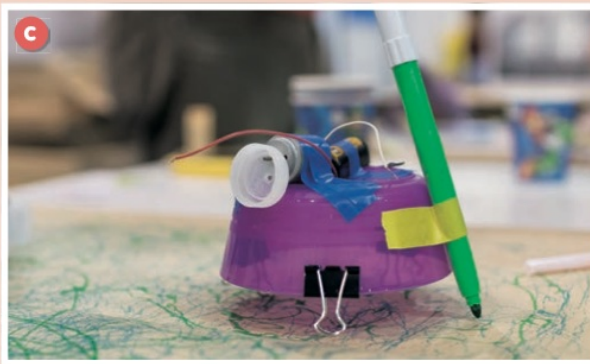
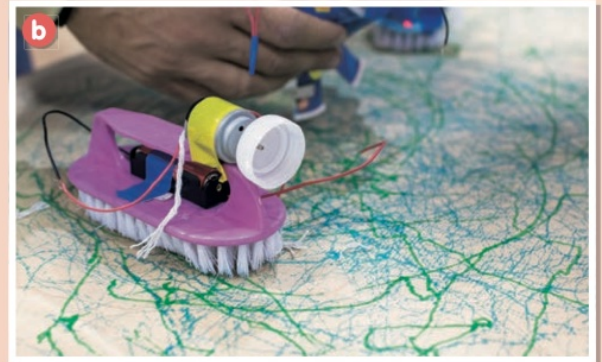
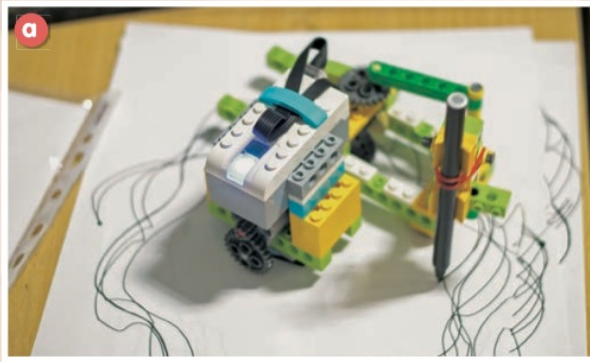


3

Present the robots

Each group presents their robot and makes it work. The speaker for each group explains the difficulties they had while building and discusses the solutions. The other groups ask questions.

Here are some examples of painter robots:



4

Display the robots

Organise an exhibition featuring the robots in the entrance to the school and share this experience with the other pupils.

Find out more about
how to build a
robot at:

www.tiching.com/777857

**Think and answer**

- What did you think of the activity? Was it hard to organise the groups and decide who would do what?
- Did you ask your teacher for help?
- What was your favourite part of the activity?
- Did you have to apply basic concepts of mathematics, physics or mechanics? Which ones?

1. Copy and complete in your notebook:

- Three essential characteristics of a ... are intensity, ... and sense.
- When we stop applying force to an ... object, it returns to its original shape.
- Devices such as computers run on ... energy. Jet engines use ... energy.
- The three types of force an object must withstand are ..., variable and ... forces.
- The motion of electric ... through a material is called electric
- There are two kinds of ... charge: ... (+) and ... (-).
- The energy required to move an electric current is provided by a
- ... allow electric current to pass through them.
- We can use a ... to turn the electric current on or off in an ... circuit.
- Two magnets with ... charges attract each other. Two objects with like charges ... each other.

2. In your notebook, say which of the following materials are electrical conductors and which are insulators:

copper	cork	paper	wood	fabric	gold
plastic	iron	rubber	aluminium		

3. Indicate in each case if the magnets attract or repel each other. Then, describe in your notebook the relationship between electricity and magnetism.



4. Look at all the electrical devices in your kitchen:

- List them.
- What do they transform electrical energy into?
- Does any device use a force to transfer energy? Which force?
- Which of the previous electrical devices also use magnetism?



1. Rewrite these sentences in your notebook, starting with the given word or words.

For example:

The lightning hit the kite.

The kite was hit by the lightning.

- a) Energy can deform an object.
An object can be ... by energy.
- b) Alexander Graham Bell invented the telephone in 1875.
The telephone was ... by Alexander Graham Bell in 1875.
- c) People use robots to do difficult and dangerous jobs.
Robots are ... to do difficult and dangerous jobs.
- d) Electrically charged objects attract light objects.
Light objects are ... by electrically charged objects.
- e) Charged objects exert forces.
Forces are ... by charged objects.
- f) Generators produce energy.
Energy is ... by generators.

2. Complete the sentences below in your notebook, with the following words:

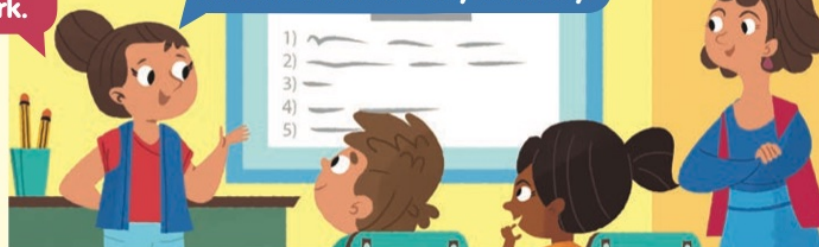
between – up – towards – into – through – off – together

- a) The stream of water falls ... the ground because of gravity.
- b) Do not forget to turn ... the TV before you go to bed.
- c) Modular structures have different parts that fit
- d) When electric charge flows ... a material, we call it electric current.
- e) We can transfer an electric charge ... a plastic rod and a piece of woollen cloth through friction.
- f) An electric fan converts electrical energy ... mechanical energy.
- g) The magnet on a compass lines ... with Earth's magnetic field.

3. Tell the other pupils about the problems you had and their solutions, while you were building your robot. Use the speech bubbles below to help with the activity on pages 128-129.

We had some difficulties in getting the motor to work.

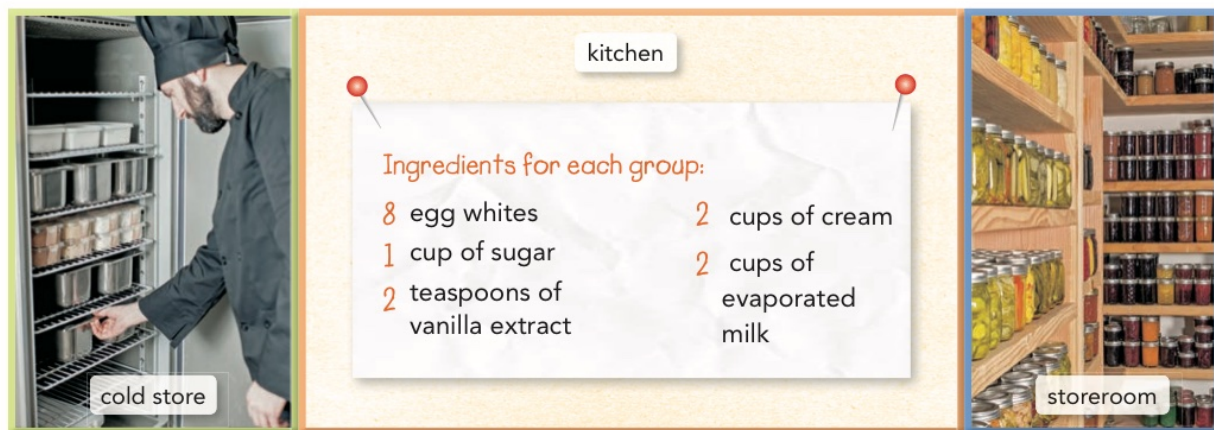
The solution was to check the wire connections very carefully.



Practise your skills

1. Your school has organised a food day, and pupils from the sixth year are going to make ice-cream.

a) Look at how the school kitchen is organised and think about the ingredients we need.



b) Find out the origin of the ingredients (animal, vegetable or mineral) and write them in your notebook.

c) Are they raw materials or products that have already been processed?

2. Follow the instructions in the recipe to make homemade ice-cream.

a) Why do we beat the ingredients?
Explain this in your notebook.

b) The vanilla extract was stored in an airtight container in a dark cupboard. Do you know any other substances that are stored in this way? Which ones?

c) Explain why they are stored in this way.

d) Which ingredient must we change to make chocolate ice-cream instead?

Ice-cream recipe

- 1 Beat the egg whites with the sugar and, when they are mixed, add the vanilla extract.
- 2 Continue beating until the mixture is a pale yellow colour.
- 3 Continue beating and add the cream and evaporated milk. Beat everything together until it becomes thick.
- 4 Freeze the ice-cream as quickly as possible in an ice-cream maker and store it in the freezer. This prevents ice crystals forming and gives it a creamy texture.



3. In the kitchen, we can read about the industrial process for manufacturing ice-cream.

The factory starts by mixing the ingredients, and the process continues in the following way:

The mixture is heated to 72 °C to kill bacteria and prevent health risks. This is pasteurisation.

The ice-cream is passed through a sieve with tiny holes which break up any lumps of fat. This is homogenisation. It ensures that the ice-cream is creamy.

- Read the text and look for the information you need. In your notebook, describe pasteurisation and say what its purpose is.
- What is the difference between a homogeneous mixture and one that is heterogeneous? In your notebook, explain what the homogenisation process consists of.

To find out more about different methods of food preservation, go to:

www.tiching.com/776290



4. When you have finished the process, put the ice-cream in the freezer in expanded polystyrene containers. This is a plastic material that looks like solid foam. Answer the questions in your notebook:
 - a) One group left the ice-cream out of the freezer and found it soft and almost liquid. Why did this happen?
 - b) Find out more about expanded polystyrene and describe what characteristics make it perfect for storing ice-cream.
 - c) The cooks warn us that the door of the cold store should stay closed at all times. Why?
 - d) If we leave the door open, does cold leave the cold store or does heat enter from the rest of the kitchen? Explain your answer.
5. When we went into the storeroom, we switched on the light because it was very dark:
 - a) Remember what an electric circuit is. What are the different parts?
 - b) Which part of a circuit generates the electric current?
 - c) What does the switch do?
 - d) Draw the plan of an electric circuit.
6. In the kitchen, we can see and use many appliances.
 - a) Get into groups. Each group should choose one of these appliances from the kitchen, and write a short report about it: use, origin, materials, recycling, etc. Look for more information on the Internet.

microwave oven

dishwasher

mincer

cold store

ice-cream maker

freezer

blender

thermometer

induction cooker

fridge

extractor hood

oven



- b) Which of these apparatus existed in the early 20th century but did not use electricity? What are the advantages and disadvantages of electrical appliances?
 - c) When you have finished, one speaker from each group will read the report to the class. Together, decide which appliance is the most important to help prepare and cook food.
7. Many technological advances have been possible thanks to the invention of materials with specific properties.
 - a) Look at the photo. What is the purpose of these containers?
 - b) From the interior to the outside, each container has:
 - ✓ 1 layer of aluminium
 - ✓ 1 layer of special paper
 - ✓ 3 layers of polythene (plastic)
 - c) Look on the Internet and find out what properties these materials must have to preserve the liquid.

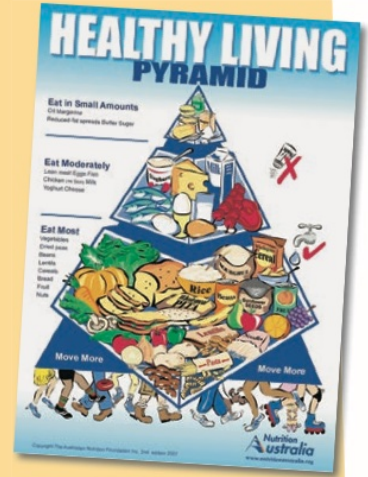


Healthy habits day

Having healthy habits helps us to feel good, because it makes us feel more comfortable with ourselves and with the world around us. In this project you are going to organise and participate in a healthy habits day and record a radio interview to evaluate your experience.

Find out and answer:

- ✓ How can we improve our eating habits? Why is it necessary to do regular physical exercise?
- ✓ What is hygiene? What should we do to improve our safety at home and in our environment?
- ✓ What is addiction? How can we prevent it?



FIRST STEP: What do we already know and what do we want to find out?

- a. Before starting your project, you need to remember what habits are essential for a healthy life.
- b. Say if the following sentences are true or false. Then, correct the mistakes in the incorrect sentences.
- c. Add other statements that you consider necessary to maintain healthy living habits.



	True	False
To have a healthy diet you should eat the same thing every day.	☐	☒
Doing physical exercise is very good for your health.	☐	☐
Good hygiene is a source of infections and diseases.	☐	☐
Safety is an essential part of health.	☐	☐



PLANNING. What do we have to do?

- a. **Divide the class into four groups.** Each group will hold a workshop on one of the four topics in the document below. The objective of each workshop is to do the listed tasks.
- b. **After your group has chosen a topic,** do some research so that you can answer questions that pupils in your workshop might ask when they are doing the tasks.
- c. **Think about how to organise your workshop.** Your teacher will be able to help with this.
- d. **Design a poster for your workshop.** Make sure it explains what the workshop is about and illustrates points that you will talk about.
- e. **After you research your topic,** you can change any of the tasks if you want to.

• healthy eating

Write the keywords of the subject you are working on into a search engine. Think about what you talked about during the first step.

Search engine

Workshops on healthy habits

1. Designing a balanced menu:

- Find out how often we should eat different foods.
- Think about what the ideal diet for healthy eating every day should include.
- Propose a menu for one day: breakfast, a mid-morning snack, lunch, an afternoon snack and dinner.
- Write down the recipe of one of these meals, saying which ingredients are rich in vitamins, minerals, fibre, proteins, fats and carbohydrates.



2. Making a list of rules about hygiene and safety:

- Define what hygiene is and the rules to prevent accidents at home.
- Make a list of good habits to have good personal hygiene, to look after our bodies, to look after our things, etc.
- Establish basic safety standards in the home and the environment.



- Illustrate the list with images that represent each one of the suggestions or rules you have written down.

3. Creating a physical exercise plan:

- Explain the benefits of physical exercise.
- Describe what daily activities involve movement. Make a table with two columns: The exercise I do / The exercise I could do.
- Develop a weekly physical exercise programme: at school, and at the weekend with friends.

4. Designing an advertising campaign for addiction prevention:

- Share information about different addictions to toxic substances.
- Talk about addiction to new technologies (Internet, mobile, video games, etc.)
- Think about and design an attractive campaign to combat addiction.



ACTIVITY. How do we do it?

The organisation of the teams is very important to make this day successful.

- Organise the four workshops at different times so that everyone can participate. Working together will help you make the day a success!



hygiene and accident prevention plan



a physical exercise programme



- At the end of the day of healthy habits, have an extra session to share the results of the workshops.

EVALUATION. What have we learnt?

To evaluate your knowledge, you will now prepare a radio interview with your classmates in which you ask them about the experience of participating in this day.

1. In groups, prepare the script and decide who will be the interviewer and who they will interview.
2. Make the recording with a mobile phone or a digital tablet.
3. Share your evaluations with the whole class.



Interview script:

1. What is a healthy diet? Why is it important to maintain a balanced diet?
2. How does physical exercise affect our health?
3. What do we mean when we talk about hygiene and safety?
4. Can abuse of new technologies become an addiction? Why?
5. Do you think your personal habits are healthy? How could you improve them?
6. Do you think it is useful to participate in a healthy habits day? Why/Why not?



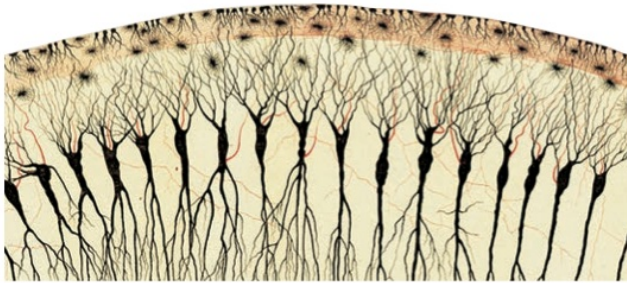
4. Finally, copy the table below into your notebook and complete it with a general assessment of the activities in your project.

					
Digital presentation	It includes the title of the workshops and the times they are held. The presentation includes images related to the topic.				
Contents summary	All programme questions are answered and the information is well structured. There are images and / or videos to support the content.				
Oral explanation	It was well prepared and well organised.				

Spain has always produced important scientists but, in recent years, science in this country has made many great advances and today Spanish scientists are among the best in the world.

Santiago Ramón y Cajal (1852-1934)

Doctor who specialised in the study of the tissues of living things. He shared the Nobel Prize for Medicine in 1906 with Camillo Golgi in 'recognition of their work on the structure of the nervous system'. He showed that this system consists of separate cells (neurons) that communicate with each other.



If I have seen further it is by standing on the shoulders of giants.

Isaac Newton, 1676

Leonardo Torres Quevedo (1852-1936)

Mathematician, road engineer and inventor. He invented and built the Telekino (a radio-controlled robot), the first Spanish airship, the first cable car for public use, various calculating machines, and the Chess Player Automaton. He also built the aerial cable car over Niagara Falls, which is still working.



Severo Ochoa de Albornoz (1905-1993)

Doctor and biochemist. In 1959, together with his disciple Arthur Kornberg, he was awarded the Nobel Prize for Medicine.

He studied cell respiration and photosynthesis. His synthesis of ribonucleic acid, RNA, allowed work to start on deciphering genetic code.

Margarita Salas Falgueras (1938)

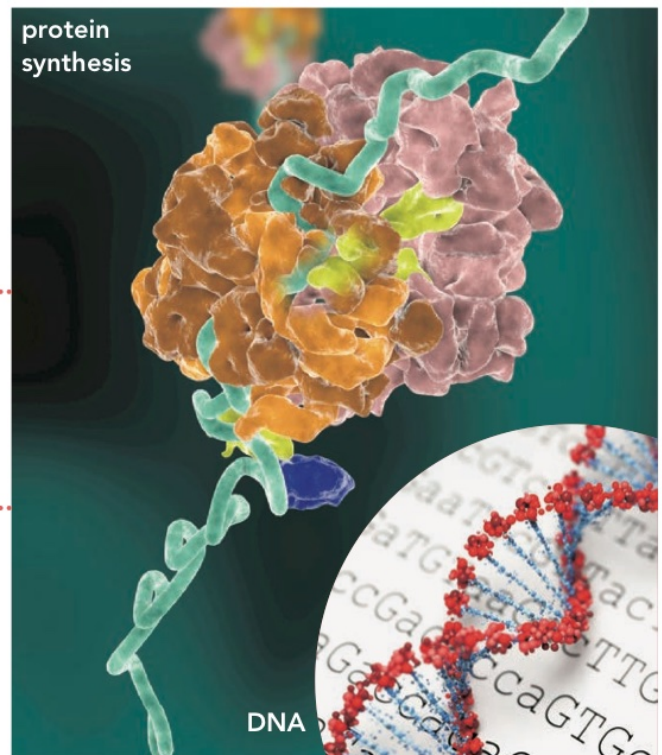
Biochemist and disciple of Severo Ochoa. Her work on viruses helps us understand how their proteins are encoded.

María Blasco Marhuenda (1965)

Biologist specialising in ageing and cancer. She received a doctorate under the direction of Margarita Salas.

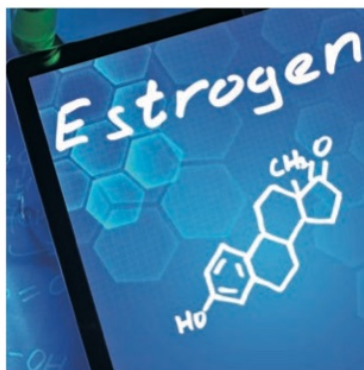
In 2003, she joined the National Oncology Research Centre (CNIO), an institution dedicated to the study of cancer, and has run it since 2011.

protein
synthesis



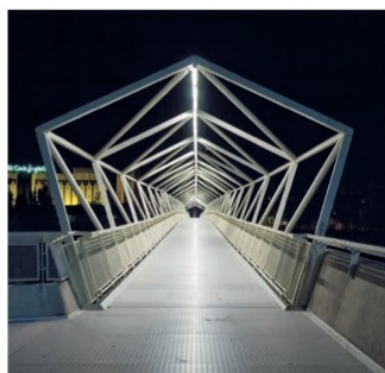
Sara Borrell Ruiz (1917-1999)

Pharmacist and biochemist noted for her pioneering work on the analysis and metabolism of steroid hormones (estrogens, etc.).



José Antonio Fernández Ordóñez (1933-2000)

Civil engineer who combined functionality and beauty. Creator of outstanding projects, such as the new Puente del Diablo in Martorell (Barcelona).



Rafael Moneo Vallés (1937)

Architect awarded the Pritzker Prize for architecture (in 1996) and creator of works such as the walkway in the Science Museum in Valladolid.

Pilar Carbonero Zalduegui (1942)

Agricultural engineer working in plant biotechnology. She has focused much of her research on the problem of world hunger and food supply.



Juan Luis Arsuaga Ferreras (1954)

Biologist who studies the evolution of the human species from fossil remains. Researcher at the Atapuerca Mountains (Burgos, Spain) since 1982 and vice president of the Atapuerca Foundation.



Francis Martínez Mojica (1963)

Microbiologist whose discoveries in bacteria helped the development of CRISPR-Cas technology, which has been widely adopted in genetics. He also studies the use of viruses as an alternative to common antibiotics.



Juan Ignacio Cirac Sasturain (1965)

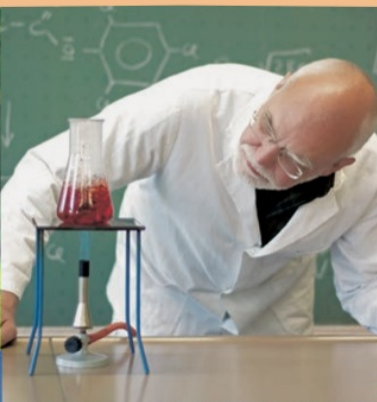
Research physicist focusing on the quantum theory of information. He has developed a computer system that is expected to allow more efficient and secure communications.

Elena García Armada (1971)

Industrial engineer specialising in robotics. She leads the CSIC group, which has developed the world's first bionic exoskeleton for children.



Glossary



1 How do we respond to stimuli?

central nervous system (n): the part of the nervous system that consists of the brain (cerebrum, cerebellum and brainstem) and spinal cord.

decibel (n): a unit used to express the intensity (loudness) of sound.

eardrum (n): the membrane which transmits vibrations from the outer ear to the middle ear.

endocrine system (n): the system that controls the release of hormones into our body.

epidermis (n): the outer surface layer of our skin.

hearing (n): the ability to detect sounds with our ears.

hormone (n): a chemical substance produced in the body that regulates processes, such as growth or the amount of sugar in the blood.

interaction (n): the life process in which living things react to stimuli.

involuntary action (n): an automatic action performed by our body, which we do not control.

muscular system (n): the system of muscles and tendons in our body.

musculoskeletal system (n): the system of bones and muscles that allows us to move.

neurons (n): the specialised cells that make up the nervous system.

nerve (n): a long fibre that transmits signals between the central nervous system and the rest of the organism.

nervous system (n): the system that transmits signals to our body and controls our actions.

nutrition (n): the life process in which living things feed and get nutrients.

organ (n): a group of different tissues which together perform a specific function.

reflex action (n): an involuntary movement that occurs almost immediately after responding to a stimulus (e.g. moving our hand away after touching something hot).

reproduction (n): the life process in which living things create similar living things.

retina (n): the part of the eye that detects light and forms images.

senses (n): the five powers that help us to detect stimuli around us.

sight (n): the ability to see things with our eyes.

skeletal system (n): the system of bones and cartilage in our body.

smell (n): the ability to detect smells with our nose.

stimulus (n): a change in an environment that a living thing detects and either reacts to or interacts with.

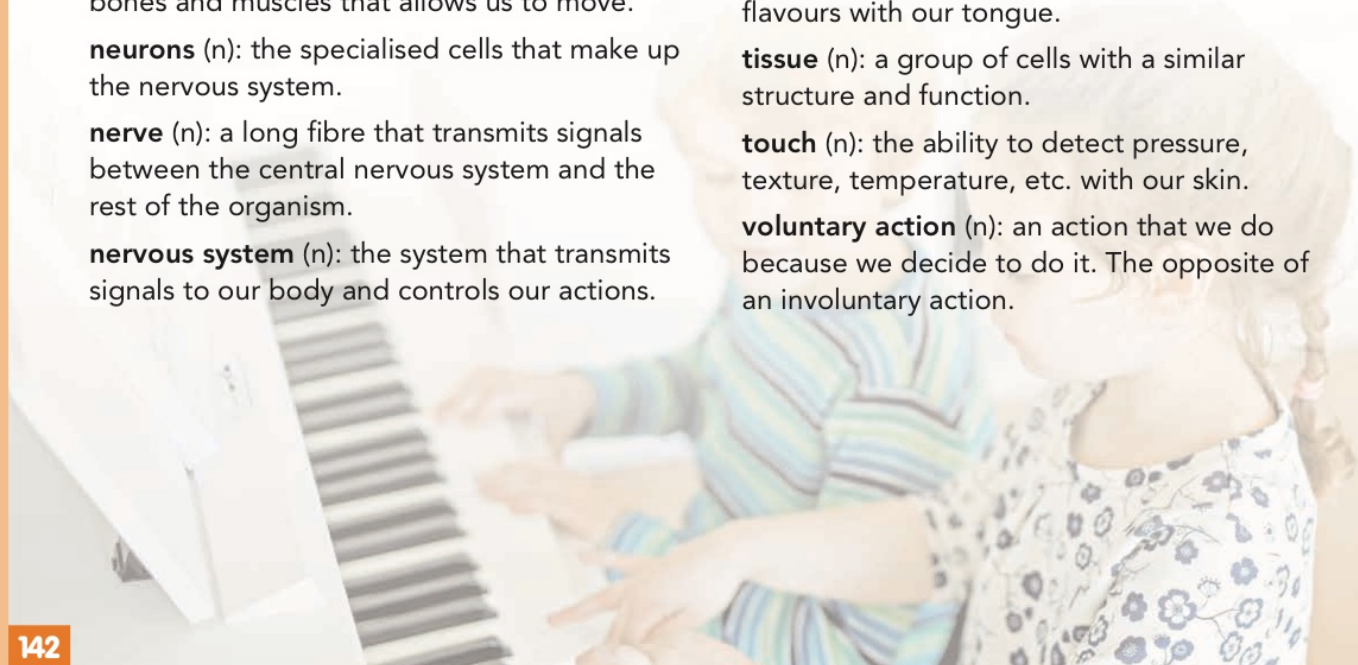
system (n): a group of organs which work together to perform a function.

taste (n): the ability to detect tastes and flavours with our tongue.

tissue (n): a group of cells with a similar structure and function.

touch (n): the ability to detect pressure, texture, temperature, etc. with our skin.

voluntary action (n): an action that we do because we decide to do it. The opposite of an involuntary action.



absorption (n): when nutrients pass into the blood after digestion.

bladder (n): the bag where urine collects before it is expelled from the body.

bronchi (n): the final part of the respiratory tract, where it enters the lungs.

bronchioles (n): the fine tubes that connect the bronchi to the pulmonary alveoli.

carbon dioxide (n): a waste gas produced in cellular respiration and expelled from the body when we breathe out.

circulatory system (n): the system that takes nutrients and oxygen to all the cells in the body and takes waste substances away from the cells.

cellular respiration (n): the exchange of oxygen and carbon dioxide between the blood and cells.

defecation (n): the elimination of undigested material from the body.

diaphragm (n): the large muscle that contracts to fill the lungs with air and relaxes to empty them.

digestion (n): the process by which food is broken down into substances that the blood can absorb.

excretion (n): the expulsion of waste products from the body.

exhalation (n): breathing out; expelling air from our lungs.

gland (n): organ or group of cells that makes a substance such as a hormone.

ingestion (n): when the food enters the mouth.

inhalation (n): breathing in; taking air into our lungs.

intestine (n): long organ in the shape of a tube, which food passes through after it leaves the stomach.

kidneys (n): the organs that remove waste products and excess water from the blood.

lungs (n): the bag-like organs that inflate and deflate, making us breathe in and out.

nephrons (n): the many, tiny filters in the kidneys that clean the blood.

oxygen (n): a gas in the air, which mixes with nutrients in our cells to give them energy.

pulmonary alveoli (n): the many tiny air bags in the lungs through which oxygen enters the blood and carbon dioxide leaves it.

respiratory system (n): the system in the human body that enables us to breathe.

respiratory tract (n): the tube that connects the nose and mouth to the lungs so that we can breathe.

sphincter (n): a muscle round an opening in the body, which can contract to close the opening.

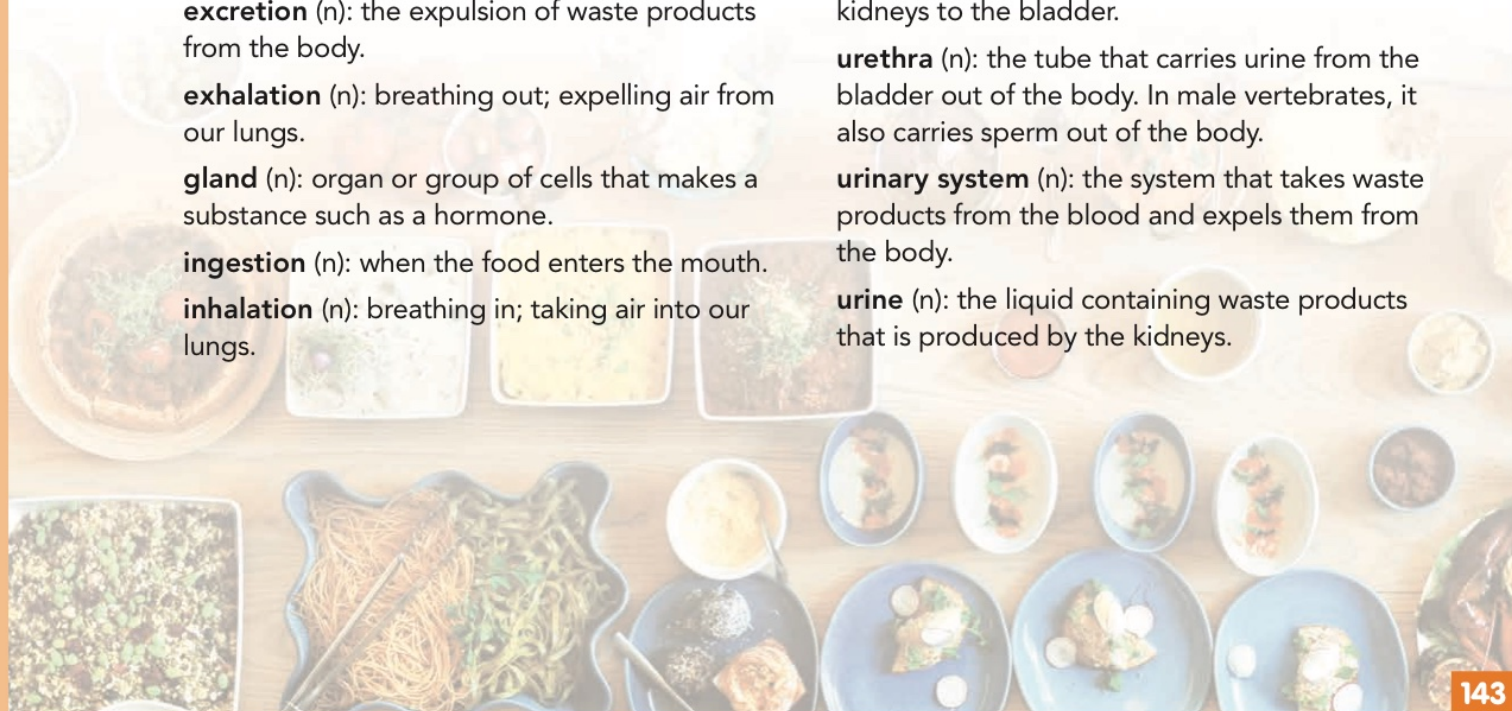
stomach (n): the internal organ where digestion takes place.

ureters (n): the tubes that carry urine from the kidneys to the bladder.

urethra (n): the tube that carries urine from the bladder out of the body. In male vertebrates, it also carries sperm out of the body.

urinary system (n): the system that takes waste products from the blood and expels them from the body.

urine (n): the liquid containing waste products that is produced by the kidneys.



3 How is a human life created?

birth (n): the emergence of a baby or other young animal from its mother.

egg (n): the female sex cell.

embryo (n): a young human that is developing in the mother's uterus.

Fallopian tubes (n): two ducts that connect the ovaries to the uterus.

fertilisation (n): the moment when a sperm and egg come together to generate a new life.

foetus (n): the embryo, after the organs have started to develop.

menstruation (n): when the inner wall of the uterus breaks down and is released along with the unfertilised egg. It is also known as a period.

navel (n): a scar on the abdomen that marks the place where the umbilical cord was attached. It is also called a belly button.

ovaries (n): the female organs which produce eggs.

ovulation (n): the release (every 28 days) of an egg from one of the ovaries.

penis (n): the organ through which the male transfers sperm to the female, and also urinates.

pregnancy (n): when a foetus is developing in a woman's uterus.

primary sexual characteristic (n): the organs and other structures that form part of the male or female reproductive systems.

prostate (n): a gland in males that produces a liquid that feeds sperm and helps it to move.

puberty (n): the time when a child becomes an adult and can have children.

secondary sexual characteristic (n): features not required for reproduction that allow us to tell the difference between males and females (e.g. beards and breasts).

sperm (n): male sex cells.

STI (n): a contagious disease that spreads through unprotected sexual contact. It stands for 'sexually transmitted infection'.

testicles (n): the male organs, which produce sperm.

umbilical cord (n): the tube that connects the embryo or foetus to the mother's body.

uterus (n): the womb; the place where the embryo develops.

vagina (n): the passage between a woman's external sexual organs and her uterus.

vas deferens: two ducts that connect the testicles to the penis.

vulva (n): the external part of a woman's sex organs.

zygote (n): a cell formed when a male and a female sex cell join together.



accident (n): an unexpected event that can cause injury.

aerobic exercise (n): moderate or low-effort exercise, such as running or swimming.

bacteria (n): microscopic organisms that can cause disease.

balanced diet (n): the consumption of the right amount of essential foods every day.

burn (n): an injury caused by heat.

choking (n): when the airways become blocked by food or another object.

degenerative disease (n): a disease caused by chronic cell changes that get worse over time.

diet (n): the type of food that we eat.

disease (n): a condition that affects health, that may result from infection, deficient nutrition or environmental factors.

disinfect (vb): clean with a substance that kills bacteria.

drug (n): a chemical substance that affects the way our body works. Some drugs are bad for us, others can be medicines.

first aid (n): techniques to help someone who is feeling ill, or who has suffered an injury.

food poisoning (n): an infection caused by eating food contaminated by bacteria, viruses or parasites.

food pyramid (n): a diagram that shows how often different foods should be consumed.

genetic disorder (n): a medical problem caused by alterations in the genes of a person's cells.

harmful (adj): causing or able to cause damage to.

health (n): a state of physical, mental and social wellbeing.

healthy (adj): (1) when we are not ill and our bodies work well. (2) to describe something that is good for us and keeps us well.

Heimlich manoeuvre (n): a technique to help someone who is choking.

ill (adj): not well; suffering from a disease.

illness (n): a period of sickness that affects either the body or the mind.

infectious (adj): spread by microorganisms from one person to another, or around the body.

injury (n): physical harm to a body.

obesity (n): the state of being very overweight.

ointment (n): a medicine in the form of a cream or paste that you apply to the skin.

personal hygiene (n): habits, such as having a shower, that help people stay healthy.

surgery (n): when a surgeon cuts open your body to repair or remove something.

symptom (n): an indication that we are ill or that something is wrong.

toxic (adj): having a harmful effect on people's health.

vaccine (n): a substance that prevents the most serious infectious diseases, such as polio and measles.

virus (n): a very small infectious agent that causes an illness.

wound (n): a break in the skin, such as a cut or a scratch.



5 The relationship between matter and energy

buoyancy (n): the ability of an object to float or rise up in a fluid.

chemical change (n): a process in which one substance changes into another one due to a chemical reaction.

combustion (n) oxidation that occurs when oxygen reacts with combustible substances.

conductivity (n): the ability of a substance to transmit heat or electricity.

corrosion (n): oxidation that occurs when oxygen reacts with metal.

decantation (n): a process to separate mixtures by removing a layer of the liquid component from the solid component of a mixture.

density (n): the relationship between the mass and volume of an object.

distillation (n): a process of evaporation and condensation that separates liquids in a mixture.

evaporation (n): a process in which a liquid turns into a gas. This process can be used as a separation technique.

fermentation (n): a chemical change that produces organic substances.

filtration (n): a process to separate solid particles from a gas or a liquid by passing the mixture through a filter.

heterogeneous mixture (n): a mixture in which you can see the different components.

homogeneous mixture (n): a mixture in which you cannot see the different components.

insulation (n): the ability of a substance not to transmit heat or electricity.

lens (n): a circular piece of transparent material that refracts light to make objects look bigger.

material (n): substance that we use to make things.

matter (n): anything that has mass and volume; everything in the universe is made of matter.

mineral (n): substance that forms naturally in rocks.

mixture (n): a substance that is made up of two or more pure substances.

oxidation (n): a chemical reaction that occurs when oxygen reacts with other substances.

physical change (n): a process in which a substance takes on a different form, but stays chemically the same.

prism (n): a piece of transparent material that separates white light into its component colours.

property (n): a quality or characteristic.

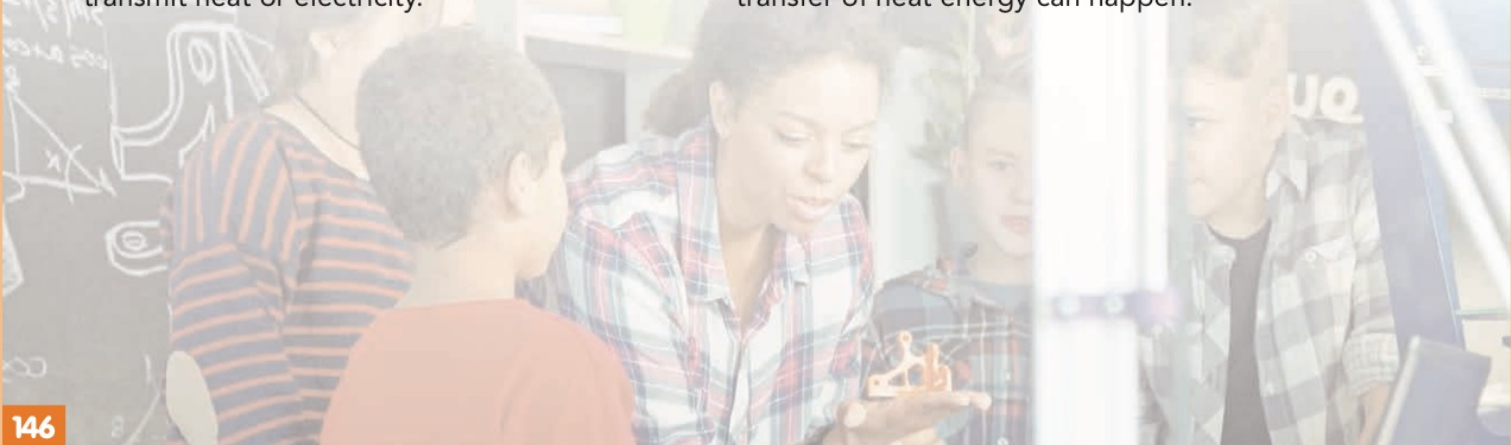
raw material (n): a natural resource we can use to make materials.

reflection (n): when light bounces off an object.

refraction (n): when light changes direction as it passes from one transparent medium to another.

solution (n): a homogeneous mixture.

thermal equilibrium (n): when two or more objects have equal temperatures so no transfer of heat energy can happen.



alternating current (n): when the electric charge flows in both directions alternately.

battery (n): a device that uses chemical energy to produce electrical energy.

deformable (adj): the quality of an object that will change shape permanently due to the action of a force.

direct current (n): when the electric charge flows in one direction only.

dynamo (n): a device that uses kinetic energy to produce electrical energy.

elasticity (n): the ability of a substance to return to its former dimensions after deformation.

electric charge (n): the electric property of matter. It can be positive or negative.

electric circuit (n): a series of components used to generate, distribute or use an electric current.

electric current (n): the movement of an electric charge.

electric machine (n): a machine that uses electrical energy to transfer force.

electrical device (n): any apparatus that works using electricity.

electromagnet (n): a device which becomes magnetic thanks to an electric current.

force (n): something that changes the movement or shape of a body that it acts on.

generator (n): a machine that converts other forms of energy into electricity.

gravity (n): the force that keeps us on the Earth's surface.

intensity (n): the strength of a force.

line of action (n): the line along which a force acts, passing through the point at which the force is applied.

magnet (n): an object that has the property of attracting iron and some other metals.

magnetic field (n): area of magnetic effect around a magnet.

mechanical machine (n): a machine that uses mechanical energy to transfer force.

plasticity (n): the ability of a substance to retain its new shape after deformation due to force.

robot (n): a machine designed to carry out work autonomously.

sense (n): direction of a force along a line of action (up or down; left or right, etc.).

socket (n): the place where you plug in an electrical appliance.

speed (n): the rate of movement of an object.

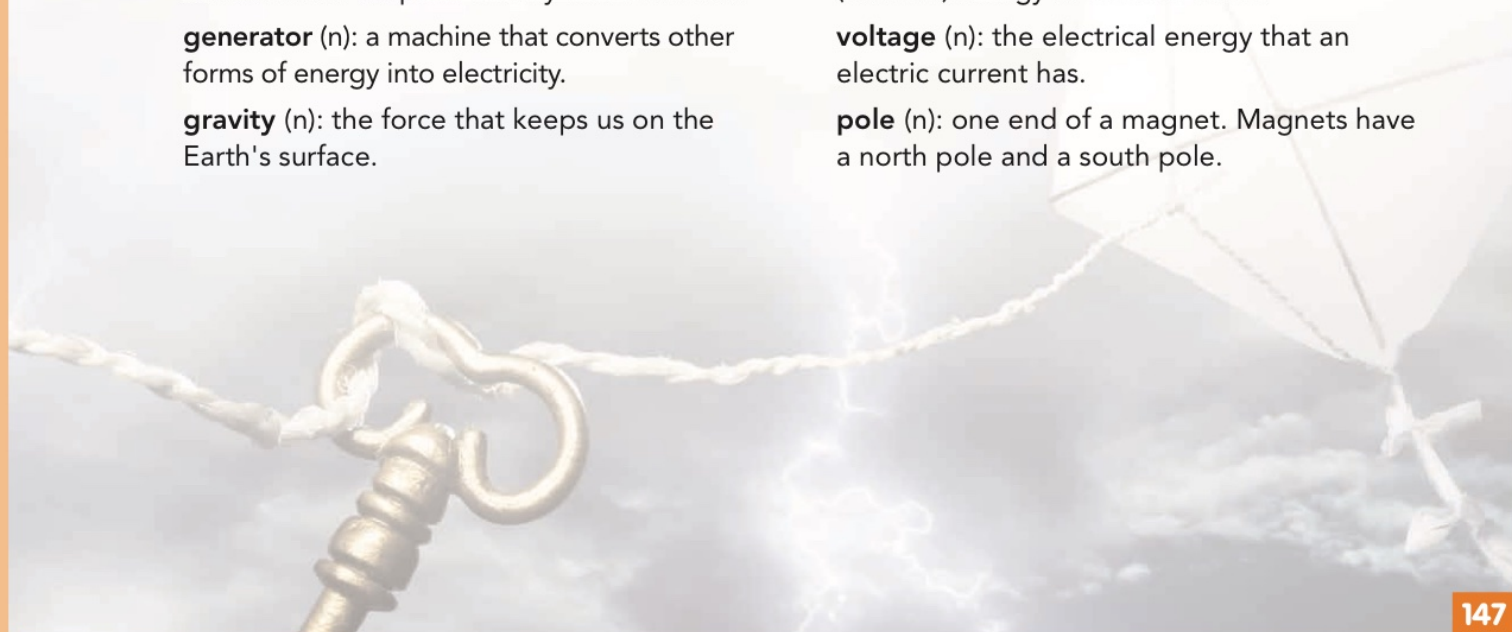
structure (n): the way in which different parts of a machine or building are put together.

switch (n): a small device that allows you to turn an electric current on and off.

thermal machine (n): a machine that uses heat (thermal) energy to transfer force.

voltage (n): the electrical energy that an electric current has.

pole (n): one end of a magnet. Magnets have a north pole and a south pole.



PROJECT

ZOOM



NATURAL SCIENCE



Vicens Vives